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BARNES (H. F.). **Studies of Fluctuations in Insect Populations. X. Prolonged larval Life and delayed subsequent Emergence of the adult Gall Midge.**—*J. Anim. Ecol.* **12** no. 2 pp. 137–138, 3 refs. London, 1943.

The following is substantially the author's summary of these further investigations on the Cecidomyiids that infest wheat at Harpenden [*R.A.E.*, A **30** 91] carried out in the insectary in 1939–43. The emergence of adults of *Contarinia tritici*, Kby., occurs in the autumn of the year in which the larvae attack the wheat, during the next spring, and after a lapse of two winters. Its parasites generally emerge after the first winter, but sometimes do so only after the second. The emergence of adults of *Sitodiplosis mosellana*, Géh., takes place up to four years after the larvae have attacked the wheat, but not in the same year. The parasites that were reared survived two winters in the soil. The effect of this variability in preserving the species and as a cause of sudden increases in numbers is pointed out. The parasites reared have not yet been identified.

PETHERBRIDGE (F. R.) & WRIGHT (D. W.). **Further Investigations on the Biology and Control of the Carrot Fly** (*Psila rosae* **F.**).—*Ann. appl. Biol.* **30** no. 4 pp. 348–358, 3 figs., 4 refs. London, 1943.

Investigations on the bionomics and control of *Psila rosae*, F., on carrots were continued in eastern England in 1942 [*cf. R.A.E.*, A **31** 229]. Emergence of adults of the overwintered generation began about mid-May and soon reached its peak but continued for over two months. A marked correlation was found between the age of the crop and the date on which first-generation adults began to emerge from it, emergence from crops sown in late March, on 13th April and on 27th May beginning on 20th July, on 4th August and at the end of August, respectively. The relation depends on the length of the emergence period of the overwintered generation and the time at which the crop becomes susceptible, which in the case of carrots sown later than April was about a month after sowing ; the minimum period required for development from egg to adult is two months.

The bait-spray of 2·5 per cent. cane molasses and 0·8 per cent. sodium fluoride [*cf.* **31** 230] gave satisfactory control of the adults of the overwintered generation when applied six times between 22nd May and 12th June to the dikes surrounding early carrot fields, and caused a marked reduction in infestation by the subsequent first generation. It also controlled adults of the first generation in five main-crop fields that were treated 11 times between 11th August and 21st September, but was less successful in three others owing to weeds and a neighbouring unsprayed field that provided shelter for the adults and the fact that the headlands were not all sprayed.

In all the field experiments, the spray was applied to both sides of the dike or hedge, and power-operated equipment fitted with coarse nozzles to give good penetration was the most suitable. All low vegetation and bushes and the adjoining rows of potato fields were well sprayed. Spraying the headlands was found to be unnecessary for the control of the overwintered generation, and where shelter was removed by the cleaning out of dikes or the dying down of potato foliage, spraying on these sites was discontinued. The treatment was most effective when applied during warm, dull weather with little wind, when the flies are most active. It should not be carried out when the foliage is wet or when rain or dew is likely to dilute the spray. In dry weather a toxic deposit remained on the foliage for several days. Good results can be expected if conditions remain favourable for at least three hours after treatment. In laboratory tests, beet molasses was as effective as cane molasses in this bait-spray.

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Good protection against infestation due to first-generation adults was given by string stretched 2 ins. above the soil between the rows of carrots and brushed thoroughly with creosote in late July and again in mid-August [*cf.* **30** 520], but no reduction in injury followed the use of grass cutting alone or with a dust of 4 per cent. calomel [mercurous chloride], which had been of value in the previous year, when infestation was less severe [**31** 230].

In hot sunny weather, the flies sheltered in the vegetation surrounding the fields from about 10 a.m. until 5 p.m., but in dull, warm weather they were in the fields throughout the day [*cf.* **31** 24]. Infestation of carrots was heaviest near hedges that sheltered the adults. Seedling carrots were found to be subject to attack at any time after the cotyledon stage, and even while they are still in it, so that main-crop carrots can be attacked by first-generation larvae. The young larva hollows out the root and kills the plant, after which it migrates to another seedling.

Observations in March showed that most of the pupae occur within 3 ins. of the roots and 2 ins. of the soil surface. In tests of insecticides to destroy them, a mixture of equal parts of creosote and sawdust applied at the rate of 2 lb. per sq. yd. gave complete control when lightly forked in April into soil from which carrots had recently been lifted, and 86 per cent. control when applied to a heavily infested clamp site. Whizzed naphthalene at 2·2 and 4·4 oz. per sq. yd. and liquid creosote at ½ pint per sq. yd. gave some control, but calcium cyanamide at the same rates as naphthalene was of no value. Deterioration from infestation was again more severe in unlifted than in clamped carrots [*cf.* **31** 230] and the number of adults emerging in spring was far less from plots in which the carrots were lifted in the previous autumn than from plots in which the carrots had not been lifted. It was also found that the numbers of larvae and pupae left in the soil increased when lifting the crops was delayed until late autumn or winter.

DANNREUTHER (T.). **A new British Moth.**—*Hastings Nat.* **6** no. 5 pp. 144–145. St. Leonards-on-Sea, 1944.

Acrolepia assectella, Zell., which had not previously been recorded in Britain, was taken at two places on the Sussex coast in 1943. Adults were reared from larvae and pupae found in leek plants in August, and a second emergence of adults occurred in October. The infestation was probably due to immigrant moths from the Continent, where this Tineid mines the leaves of onions, garlic and leeks.

JARY (S. G.) & EDELSTEN (H. M.). *Acrolepia assectella* **Zell. (Lep., Plutellidae) in England.**—*Ent. mon. Mag.* **80** no. 956 pp. 14–15. London, 1944.

Further notes are given on the finding of *Acrolepia assectella*, Zell., in two places in Sussex in 1943 [see preceding abstract] ; the larvae caused considerable damage to leeks, and onions were also said to be attacked. The biology of this Tineid is briefly reviewed from the literature.

SKOBLO (I. S.). **Ripening and Fertility of Females of** *Habrobracon brevicornis* **Wesm. as dependent on Development Conditions during pre-imaginal Phases.**—*C.R. Acad. Sci. URSS* (N.S.) **33** no. 6 pp. 424–426, 1 fig. Moscow, 1941. [Recd. 1944.]

The temperature in Azerbaijan is high from April onwards, but *Bracon* (*Habrobracon*) *brevicornis*, Wesm., which parasitises the larvae of the cotton moth [*Heliothis armigera*, Hb.], does not become active until June or July. It increases considerably in numbers towards the end of August, when it may parasitise 40–80 per cent. of the larvae, but becomes less abundant in September

and disappears by the end of the month, although temperatures are still fairly high, *Heliothis* larvae are abundant until late October or November, and in laboratory investigations on its bionomics [*R.A.E.*, A **30** 25] oviposition was found to continue until the temperature was as low as 10–11°C. [50–51·8°F.].

During observations in the autumn of 1939, it was noticed that females that had developed at 17–19°C. [62·6–66·2°F.] did not puncture the host larvae or oviposit for months, whereas those that had developed at 25–30°C. [77–86°F.] sometimes oviposited 1–3 days after emergence. More detailed investigations were accordingly made in October and November of the same year. Females that were reared and kept as adults at 30°C. began to oviposit on the day of emergence, and others that were reared at the same temperature and kept at 23–26°C. [73·4–78·8°F.], 17–19°C., and 14–16°C. [57·2–60·8°F.] had average preoviposition periods of 1·8, 2·6 and 8 days, respectively. Females reared at 17–19°C. and kept at 23–26°C. were ready to oviposit in 2–33 days, but those reared and kept at 17–19°C. had an average preoviposition period of 102 days. In further experiments, the preoviposition periods were normal if the females were kept at 23–26°C. during the egg and larval stages and at 17–19°C. during the prepupal, pupal and adult stages, or if they were kept at the lower temperature till the end of the larval stage and then at the higher one, but were prolonged if they were transferred to the lower temperature in the course of the larval stage and subsequently kept at that temperature.

The length of preoviposition period was found to reduce the fecundity of the females. Those with preoviposition periods of 1–5, 6–10 and 11 or more days at 23–26°C. deposited averages of 284·5, 146·3 and 114·4 eggs, respectively, the decrease in the total number of eggs being due chiefly to a reduction in the average number per day. The three females with the longest preoviposition periods (20, 30 and 33 days), however, deposited 240, 262 and 342 eggs. Of females kept at 17–19°C., those with preoviposition periods of 4–11 and 50–131 days deposited averages of 308 and 76 eggs.

The mean temperatures in the Kirovabad district during the first and second ten days of September are 18·9 [66·02°F.] and 17·1°C. [62·78°F.], respectively. Parasites that develop at this season are therefore likely to undergo a long preoviposition period and hibernate ; experiments have shown that females that have begun to oviposit are less resistant than those that have not. If the fecundity of the overwintered females in the field in spring is as low as that observed in slowly maturing females under experimental conditions, it would explain the scarcity of the parasite at that season. The investigations also indicate that the release against *H. armigera* of parasites reared at 25–30°C. might be effective in early summer or in autumn, when they would reduce subsequent infestation of the current cotton crop or that of the following year.

JENKINS (C. F. H.). **The Argentine Ant** (*Iridomyrmex humilis*, **Mayr**), **a new Pest in Western Australia.**—*J. Dep. Agric. W. Aust.* (2) **20** no. 2 pp. 101–107, 4 figs., 3 refs. Perth, W.A., 1943.

Iridomyrmex humilis, Mayr, was found to be present at Albany, on the south coast of Western Australia, in April 1941, and subsequently at Perth ; both areas have been placed under quarantine to prevent its spread to other parts of the State, particularly the fruit-growing districts. Its biology and economic importance and measures for its control are briefly reviewed from the literature.

JENKINS (C. F. H.). **The Apple Leafhopper** (*Typhlocyba froggatti*, **Baker**).—*J. Dep. Agric. W. Aust.* (2) **20** no. 3 pp. 190–195, 5 figs., 4 refs. Perth, W.A., 1943.

In 1942, typical leafhopper injury on apple trees in Bridgetown, Western Australia, was found to be caused by *Typhlocyba froggatti*, Baker, which had

spread to all the eastern States of Australia by 1938 and had probably been introduced on imported nursery stock. This Jassid has two generations a year in Western Australia. The overwintering eggs are laid in the young bark tissue and the summer eggs in slits in the midribs or petioles of the leaves. Hatching of the overwintered eggs takes place over several weeks, beginning in October, and the nymphs complete their development in about six weeks. The adults are active, but do not often fly far. It is doubtful whether breeding takes place on other than apple trees. The feeding of the Jassids causes discoloration and sometimes a fall of the leaves, and the fruit may be blemished both by feeding marks and by excreta [*cf. R.A.E.*, A **24** 787].

Local experiments have confirmed the satisfactory control obtained in other States with summer sprays of nicotine sulphate with soap or oil. The first application should be made when most of the overwintered eggs have hatched, but before the nymphs mature, usually at about the end of October, and the second three weeks later [*cf.* **29** 291]. When nicotine sulphate is not available, white oil (1 : 80) may be used alone, but it is less effective. If a spray is normally applied in November against looper caterpillars, the apple curculio [*Otiorrhynchus cribricollis*, Gylh.] and the bryobia mite [*Bryobia praetiosa*, Koch], nicotine sulphate may be added to it for the control of the Jassid, the formula recommended being 1 gal. white oil, 5 lb. lead arsenate, 1 pint nicotine sulphate and 80 gals. water. A spray of 1 gal. lime-sulphur, ⅜ pint nicotine sulphate and 35 gals. water is said to have given promising results in New South Wales, and an emulsion of 2 gals. kerosene, ½ lb. soap and 1 gal. water, diluted with ten times its volume of water, is recommended as a useful contact spray for many orchard pests. A consignment of the Mymarid, *Anagrus armatus*, Ashm., which parasitises the eggs of the Jassid, has been received from Tasmania [*cf.* **29** 291].

Gull (A. W.) & Adams (A. B.). **Does early Harvesting of Peas check the Pea Weevil ?**—*J. Dep. Agric. W. Aust.* (2) **20** no. 3 p. 265. Perth, W.A., 1943.

The authors record that peas of one variety, which were gathered when they were fully developed and the pods were still green, and dried in the pods, were not attacked by *Bruchus pisorum*, L., whereas those of another variety, which were allowed to ripen on the plant, were almost all infested at harvest. They suggest, therefore, that mowing the crop when the pods are full but still green, allowing them to dry off on the ground and then collecting and threshing them might be an effective method of controlling this Bruchid in Western Australia. It is possible that early harvesting may reduce the vigour and percentage germination of the peas, but it may improve their cooking quality.

Insect Pests.—*Agric. Gaz. N.S.W.* **54** pts. 10–11 pp. 467–471, 511–516, 12 figs. Sydney, 1943.

The first of these two parts of a series on insect pests in New South Wales [*cf. R.A.E.*, A **32** 141] includes brief accounts of the life-history of *Cydia pomonella*, L., on apple, pear and quince and of *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., which is the commonest fruit-fly in the coastal and some other areas of the State. Measures for the control of these pests are compulsory [*cf.* **25** 165 ; **26** 608 ; **31** 136], and information is given describing and explaining the action that is prescribed.

The second part consists of notes on the bionomics and control of the insects that attack potato. They comprise *Gnorimoschema operculella*, Zell., *Listroderes obliquus*, Gylh., and *Epilachna vigintioctopunctata*, F., which are the most injurious, cutworms and *Nysius vinitor*, Bergr., which cause much damage in some seasons, *Macrosiphum solanifolii*, Ashm., *Myzus persicae*, Sulz., Jassids

and flea-beetles, which are usually less important, *Heteronychus sanctae-helenae*, Blanch., which is sometimes a pest in coastal areas, and termites, which occasionally tunnel in the tubes.

DUMBLETON (L. J.) & DICK (R. D.). **Chemical Control of *Oxycanus cervinata* Walker. II. Experiments in 1941 Season.**—*N.Z.J. Sci. Tech.* **23** no. 5A pp. 284A–293A, 3 figs., 1 ref. Wellington, 1943.

Investigations in 1941 with baits for the control of larvae of a species of *Oxycanus*, which has now been determined as *O. cervinatus*, Wlk., probably the most injurious of the species of this genus that damage pastures in New Zealand, confirmed the efficiency of Paris green as a toxic agent [*cf.* *R.A.E.*, A **30** 385]. Baits of 50 lb. bran, 16 lb. molasses and 6 gals. water with 2 lb. Paris green, lead arsenate, arsenic pentoxide, arsenic trioxide, or derris were broadcast on 21st May, when there had already been a noticeable thinning of the pasture by the larvae. Only Paris green and lead arsenate gave significant control (72·6 and 30·2 per cent., respectively), measured by the reduction in population as compared with untreated plots by about the end of August, and Paris green was significantly more effective than lead arsenate. There was a definite correlation between the reduction in population of *Oxycanus* and the reduction in the percentage of the ground made bare. Reducing the quantity of molasses or eliminating it made no significant difference to the reduction in population caused by the Paris-green bait, and the addition of 2 fl. oz. nitrobenzene or amyl acetate as attractants did not increase its effectiveness. Baits applied at the rate of ½, 1, 1½ and 2 lb. Paris green per acre reduced the mean populations by 55, 62·1, 73·3 and 78·6 per cent. when used with 25 lb. bran, 8 lb. molasses and 3 gals. water per acre, and by 39·9, 52·9, 65·7 and 79 per cent. when used with 50 lb. bran, 16 lb. molasses and 6 gals. water.

It is difficult to discern damage in the early stages of a heavy infestation, when the larvae are numerous but small; they grow rapidly during February, March and April, with a proportional increase in the amount of grass eaten, and if the initial population is very large (more than 10–12 larvae per sq. ft.), the pasture may be completely defoliated by May. The possibility of applying control measures earlier in the year is considered, but has not yet been tested.

CHERIAN (M. C.) & RAMACHANDRAN (S.). **The Wax-moth and its Control.**—*Indian Fmg* **4** no. 2 pp. 92–93, 2 pls. (1 col.). Delhi, 1943. **Bee Enemies.**—*T.c.* no. 5 pp. 251–253, 6 figs., 1 ref.

Most of the information on *Galleria mellonella*, L., given in the first of these two papers on natural enemies of honey bees (*Apis indica*, F.) in India is similar to that already noticed [*R.A.E.*, A **28** 604]. Additional control measures comprise the removal of superfluous combs, which should be stored in an air-tight container, and exposing infested combs to the sun so that they are subjected to a temperature of 95–100°F. for 10–15 minutes and destroying the larvae that collect beneath them.

The insects discussed in the second paper are much less injurious. *Camponotus compressus*, F. [*cf.* **24** 113] is occasionally attracted to hives by the honey and pollen, when it also destroys the bees and the brood. Although present throughout India, it appears to be injurious to bees only in the south; similar damage by *Dorylus orientalis*, Westw., has been reported in the north. Recommended control measures include placing the hives on stands with legs in pans of water covered by a film of oil. *Vespa tropica*, L. (*cincta*, F.), which is present throughout India, occasionally destroys enough bees to weaken the colonies, and the Sphegids, *Palarus orientalis*, Kohl [*cf.* **25** 748] and *Philanthus ramakrishnae*, Turner, attack bees in the plains and hills of South India, respectively. The females of *Palarus orientalis* oviposit in cells that they have previously stocked

with 4–5 bees, laying one egg in each cell. The larva hatches in two days, feeds on the bees for about five and then pupates in an earthen cocoon. Adults of the Sphingid, *Acherontia styx*, Westw., sometimes enter the hives to feed on the honey, but are then killed by the bees. Larvae of *Achroia grisella*, F., damage carelessly-stored combs and feed on débris on the floor-boards of hives. The female oviposits in corners of the hive or under broken edges of the comb. The larvae hatch in 2–4 days and feed on the surface of the combs for 34–38 days, when they pupate in silken cocoons covered with frass. Infested combs should be exposed to sunlight and the floor-boards of the hives frequently cleaned.

CHERIAN (M. C.) & MARGABANDHU (V.). **Preliminary Trials with *Trichogramma* Parasites for the Control of the Cotton Boll Worms.**—*Madras agric. J.* **31** no. 4 pp. 107–111, 1 graph, 2 refs. Madras, 1943.

A species of *Trichogramma* that the authors tentatively regard as *T. minutum*, Ril., though they consider the latter doubtfully distinct from *T. evanescens*, Westw., has been found in India as a parasite of *Earias* spp. on cotton [*R.A.E.*, A **12** 379], *Proceras* (*Argyria*) *sticticraspis*, Hmps., and *P.* (*Diatraea*) *venosatus*, Wlk., on sugar-cane and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) on rice, and has been liberated for the control of *P. sticticraspis* in Mysore [**25** 479]. In 1941–42, the effect was tested of releasing this species against *Earias fabia*, Stoll, and *Platyedra gossypiella*, Saund., on cotton at Coimbatore.

In preliminary laboratory trials with eggs of *E. fabia*, a high percentage of parasitism, ranging from 59 to 100 was obtained, irrespective of whether the eggs were one, two or three days old. The number of parasites that emerged from each of 13 host eggs was either one or two, and the duration of the life-cycle ranged from 6 to 9 days, with an average of 8. Emergence from the host eggs was almost complete in two days. The total number of eggs laid by a female that survived for 11 days was 125, with a maximum of 20 in a day, estimated from the adults that emerged, whereas another female, which only lived for 8 days, laid a maximum of 53 eggs in one day. In tests with eggs of *Platyedra gossypiella*, the percentage parasitism varied from 20 to 96, only one parasite emerged from each host egg, and the life-cycle was completed in about a week.

For release in the field, *T. minutum* was bred in the laboratory in eggs of *Corcyra cephalonica*, Staint., and 18 liberations were made between 17th December 1941 and the end of February 1942 in four cotton fields, the parasites being released in the centres of half-acre plots covering each field, at the rate of 5,000 per plot every four days. Subsequent fortnightly examination of over 80,000 burst bolls from treated and untreated fields showed that the percentage infestation in both fell until February and then rose again, but the minimum was considerably lower in the treated fields than in the others.

Important Pests of Potato Crop in Kumaun and their Control.—*Leafl. Dep. Agric. U. P.* no. 114, 5 pp. Allahabad [? 1943].

In seasons of low rainfall, or those following unusually dry years, the potato crop in the Kumaun hills, United Provinces, is usually heavily infested with *Epilachna dodecastigma*, Muls., and *E. vigintioctopunctata*, F., and with cut-worms of the genus *Spodoptera*. All these insects caused considerable damage to the crop in two districts in 1939, but the two Coccinellids are particularly injurious, both the larvae and the adults feeding on the leaves of egg-plant [*Solanum melongena*], potato and cucurbits in Kumaun. In the hills the beetles are most abundant on potato from April to July and occur in small numbers on egg-plant in July and August ; in the plains they are very common and injurious on egg-plant from July to November. They devour the epidermis of the leaves,

and during a severe attack plants may wither, owing to the destruction of the epidermal layer of all the leaves. In Kumaun, the egg, larval and pupal stages last about 9, 19 and 9 days, respectively. The adults overwinter under grass and weeds, suffering heavy mortality if there is much rain or snow, and the eggs are laid in clusters on the potato leaves as soon as the plants are a few inches high in spring. No wild food-plants were found.

In April 1935, the Eulophid parasite, *Tetrastichus ovulorum*, Ferrière, attacked the eggs in one district, but did not give much control; no natural enemies of the larvae and adults were observed. Hand-picking adults and egg-masses on the crops in early spring is of considerable value. Of a number of insecticides tested, only lime-sulphur, which killed the larvae but did not affect the adults, was effective, and it is recommended that this should be applied thoroughly, particularly to the lower side of the leaves, once a fortnight from the first appearance of the beetles at a concentration of from 9 to 16 gals. per 100 gals. spray, depending on its specific gravity (from 35–23°Bé.). In any locality in which a serious outbreak of *Epilachna* has developed, the best method of eradication would be to refrain from growing any cucurbits or solanaceous plants for one season.

The eggs of *Spodoptera* are laid in clusters on stones, twigs, stems or the leaves of grasses or weeds and hatch in August or September. The larvae feed on vegetation in the ground and hibernate in cells deep in the soil. In spring they cut the young potato stems off at ground level, feeding at night and hiding in the ground during the day; they become full-grown in June, pupate in the soil and transform into adults in 3–4 weeks. Cutworms may be controlled with a bait of 25 lb. bran, 1 lb. white arsenic or Paris green, 2 quarts molasses, 2½–3 gals. water and the juice and minced pulp and peel of three lemons or oranges, broadcast or placed in small heaps 5 ft. apart over the area or put about the bases of the plants at the first sign of injury, preferably late in the evening. Ploughing the fields during winter to destroy the larvae and keeping the land free from plants during late summer will also reduce infestation.

Du Plessis (C.) & Lea (H. A. F.). **The Maize Stalk-borer** *Calamistis fusca* (**Hmpsn.**).—*Bull. Dep. Agric. For. S. Afr.* no. 238, 51 pp., 6 figs., 15 refs. Pretoria, 1943.

The results are given of investigations on the life-history and control of *Busseola* (*Calamistis*) *fusca*, Fuller, on maize, carried out in the Orange Free State in 1931–34. The first adults usually appear early in December, when most of the maize plants are normally well established. The eggs are deposited in batches of up to 150 or more, between the leaf sheath and the stem of the older plants, and hatch in about a week. The larvae feed under the leaf sheath for a short time, migrate to the top of the plant and feed on the semi-exposed leaves for a few days and then burrow into the stem. Some migrate to neighbouring plants. The larvae mature in a little over thirty days and pupate in the burrows. The pupal stage lasts about 16–20 days and the adults emerge from about the end of January and oviposit on the youngest plants available. The larvae of the second generation complete their growth during March, and most of them hibernate in the underground parts of the plant in this stage. In some years, however, a few pupate and transform to adults as much as 30 days later, and these give rise to third-generation larvae, which also overwinter if they have been able to grow large enough. During the winter, when the fields are heavily grazed, there appears to be a certain amount of migration to the roots of un-infested maize from the upper portions of the maize stubble and from stubble uprooted by the animals. Overwintering larvae are also frequently found in various common weeds growing in maize fields. The pupal stage of these larvae lasts about three weeks but does not begin until the required temperature and humidity are reached; there is a rapid increase in the rate of pupation about

a week after the first good rains. Adults lived an average of 6·7 days in the laboratory and were able to fly at least 800 yards; extremes of temperature and humidity hampered moth activity and reproduction.

The recommendations based on the control investigations, which are described in considerable detail, have already been noticed from an earlier report [*cf. R.A.E.*, A **24** 449]. The author emphasises the need for concerted action by all growers in each area and discusses a co-operative system of growing maize, which aims at controlling *B. fusca* over a period of years.

Bleton (C. A.) & Fieuzet (L.). **Les parasites du peuplier au Maroc. 2e note. Sur la biologie de** *Paranthrene tabaniformis*, **Rott. var.** *intermedia*, **Le Cerf (Lépidoptère Sesiidae).**—*Bull. Soc. Sci. nat. Maroc* **20** pp. 57–59, 1 ref. Rabat, 1941. **3e note. Sur la biologie de** *Sarrothripus revayana* **Scop. (Lépidoptère Cymbidae).**—*Op. cit.* **22** pp. 99–102, 11 refs. 1943.

These two papers belong to a series on pests of poplar in Morocco [*cf. R.A.E.*, A **27** 196]. *Paranthrene tabaniformis*, Rott., var. *intermedia*, Le Cerf, is particularly abundant on black poplar [*Populus nigra*] in the neighbourhood of Fez. The adults emerge in April and early May and begin to oviposit 3–4 days later. The eggs are laid on the leaves or twigs and hatch in a few days. The larva bores through the bark and lives for some time in the cambium, causing the formation of a gall, usually at the level of a bud. Later it bores deeply into the wood and makes a longitudinal burrow either upwards or downwards, in which it pupates in the following spring. The pupal stage lasts not more than a week, and the adults lived for an average of 13–14 days in the laboratory. The injury caused by the insect itself appears to be of little importance, but the organisms causing bacterial canker are able to enter by way of the galls [*cf.* **22** 193].

Sarrothripus revayana, Scop., is rather rare in Morocco. Adults were not observed on the wing in daytime; they lived less than a week when caged with sugar solution and young buds of black poplar. The eggs were laid on the underside of the leaves and hatched in a week. The larvae gum pairs of leaves together and feed between them, but pupate in cocoons on the lower surface of healthy leaves, or occasionally on a twig or on the trunk. The larval stage lasted from 13th to 30th September in the laboratory and the pupal stage 18 days in summer. There appear to be four or five overlapping generations between spring and leaf-fall. This Noctuid was also observed on *Salix pedicellata* and cork oak (*Quercus ilex* var. *suber*) and probably feeds on other species of poplar, willow and oak.

Mimeur (J. M.). **Présence au Maroc de** *Gossyparia ulmi* **Linn. 1767 (Hémiptère Coccidae).**—*Bull. Soc. Sci. nat. Maroc* **22** pp. 137–138, 11 refs. Rabat, 1943.

Large colonies of *Gossyparia spuria*, Mod. (*ulmi*, auct.), which had not previously been recorded from Morocco, were found in August and September on elms (*Ulmus campestris*) planted a few years before in the Middle Atlas Mountains, at an altitude of about 5,250 ft. The colonies consisted chiefly of adult females and occurred mainly on young twigs. The Coccid was not observed on old trees of *U. campestris* in Morocco, and was probably introduced on the trees on which it was found

Prebble (M. L.). **Sampling Methods in Population Studies of the European Spruce Sawfly,** *Gilpinia hercyniae* **(Hartig), in eastern Canada.**—*Trans. roy. Soc. Can.* (3) **37** Biol. Sci. pp. 93–126, 1 fig., 24 refs. Ottawa, 1943.

The following is based on the author's summary of this account of investigations in spruce forests in eastern Canada in 1932–40 to test various methods of

estimating populations of cocoons of *Gilpinia hercyniae*, Htg. The first sampling technique consisted in determining the number of cocoons in quadrates 2 ft. × 2 ft. spaced at fixed intervals in plots in representative forest types, without regard to the suitability of the situation of the individual quadrates, but variability was so great, even in nearby pure stands of black spruce [*Picea mariana*], and the number of samples required for moderate precision so large that the method was abandoned. The second technique consisted in determining the number of cocoons in quadrates 2 ft. × 2 ft. within selected areas beneath the crowns of trees and aimed at estimating the cocoon population of that part of the spruce forest most closely related to the source of the cocoons. This yielded, in most instances, a significant correlation between sample units taken under the same trees at different periods. The third technique differed from the second in that the unit of 4 sq. ft., representing each tree at each sampling period, was made up of four equal sub-samples distributed in the area under the tree; it gave a better estimate of the population under individual trees, reduced variability, increased the degree of correlation between sample units taken at different times, and provided for further reduction in the standard errors of the mean differences for the individual plots. The intra-tree variability in cocoon density was significantly less than inter-tree variability in seven samples from two plots. Analysis of the sample data obtained by the third method, assuming the sub-samples to represent independent varieties, showed a higher variability of the one-square-foot quadrates, a proportionately smaller standard error of the mean due to four-fold increase in the number of sample units, but, in the majority of cases, a reduction in the precision of mean differences between successive samples, as contrasted with the method of pooling the sub-samples under the individual trees. It is concluded that, where successive samples in the same plot are contemplated, and where correlation is moderately high, the method of pooling a number of sub-samples taken under each tree to give an estimate for the tree as the sampling unit, is superior to taking the same number of quadrates without regard to their disposition within the sampling area. The distributions obtained by the third sampling method were investigated for two plots over a three-year period. In one plot the distributions conformed neither with the Poisson series nor with the normal distribution, but were consistently positively skewed, and leptokurtic in two out of three instances. In the second plot, two of the three distributions showed no significant departure from normality. The third distribution was positively skewed.

EDDY (C. O.). **Entomological Progress. Number 3.**—*Bull. La agric. Exp. Sta.* no. 350, 52 pp., 7 refs. Baton Rouge, La., 1942. [Recd. 1944.]

This bulletin comprises a series of reports on work in Louisiana in 1940.

I. J. Becnel (pp. 3–9) gives an account of continued experiments against *Psallus seriatus*, Reut., on cotton [*cf. R.A.E.*, A **29** 599]. Highly significant reductions in populations of nymphs and adults occurred in plots dusted with sulphur (325-mesh) alone or with calcium arsenate (2 : 1) or Paris green (93 : 7), but, except for a greater reduction of adults by the sulphur dust than by the mixture with Paris green, the difference between treatments was not significant. In experiments on plots in which initial infestation was 50 per cent. lower, highly significant reductions of both nymphs and adults were given by the sulphur alone or with calcium arsenate, a dust of equal parts of sulphur and a mixture of nicotine sulphate and hydrated lime containing 4 per cent. nicotine, and another containing sulphur, cryolite and lead arsenate (4 : 1 : 1). The only significant difference between treatments was that the nicotine dust was the least effective against the nymphs. The only significant increase in the yield of seed cotton was obtained in the heavily-infested plots dusted with sulphur and

calcium arsenate, the yield from which was significantly greater than that from those dusted with sulphur only and highly significantly greater than that from the control plots.

C. O. Eddy (pp. 9–11) describes further work on the value of cryolite as an insecticide under conditions in Louisiana [*cf. loc. cit.*] and states that it was successfully used on a commercial scale. It was found to be incompatible with Bordeaux mixture, but, unlike other fluorine compounds, compatible with a number of insoluble copper compounds, such as basic copper sulphate. In general, neither cryolite nor other fluorine compounds can be used with fungicides or with alkaline diluents. A dust mixture comprising 33 per cent. cryolite, 18 per cent. basic copper sulphate (7 per cent. metallic copper) as a fungicide, 10 per cent. flour and 39 per cent. clay or talc gave satisfactory control of the tomato fruitworm [*Heliothis armigera*, Hb.] in experimental plots and on a commercial scale over a period of four years, and allowed the tomatos to grow more normally and produce better fruit that did the commonly used sprays of lead arsenate and Bordeaux mixture. It was also much more effective against the pickleworm [*Diaphania nitidalis*, Stoll, on cucurbits] than sprays of lead arsenate and Bordeaux mixture. In 1940, a dust comprising 50 per cent. cryolite, 18 per cent. basic copper sulphate and 32 per cent. inert diluent was found to be somewhat more effective against *H. armigera*. Cryolite dust gave effective control of various beetles on soy bean, and excellent control of the soy-bean caterpillar [*Anticarsia gemmatalis*, Hb.]. Applications of cryolite sprays and dusts against larvae of the corn earworm [*H. armigera*] and the grass worm [? *Laphygma frugiperda*, S. & A.] on late maize resulted in serious scorching and stunting of the plants, the sprays being the more injurious. Lead arsenate applied at intervals of a week or ten days, when infestation was severe and the plants small, gave considerable control of these pests.

E. H. Floyd (pp. 12–16) gives a report of work in progress since 1937 on the bionomics of the sweet potato weevil, *Cylas formicarius*, F., in Louisiana. In general, the life-cycle resembles that in other States [**25** 438]. Females began to oviposit about 15 days after emergence and continued for about 62 days, laying an average of 119 eggs. Oviposition occurred in every month, but was less frequent in September and October and negligible in November–March. In general, planted tubers that were exposed by cracks in the soil were most susceptible to attack, though about 5 per cent. of the infestation was caused by larvae tunnelling down through the crown of the plant. The egg, larval and pupal stages and the pre-emergence period occupied about 7, 18, 6 and 7 days, respectively, in summer, and 90, 130, 30 and 35 days in winter. The females fed and oviposited most actively at temperatures above 70°F.; oviposition ceased entirely below 60° and feeding below 47°. Exposure to 30°F. killed adults, larvae in the tubers and pupae in 7, 15 and 21 days, respectively. The winter mortality due to cold does not exceed an average of 25 per cent., but it reached 40–50 per cent. during the exceptionally cold winter of 1939–40. In experiments on the reaction of the adults to light of various qualities, which are reported at greater length in another paper (pp. 47–50), they fed and oviposited most in the violet end of the spectrum, and their activity in blue, red, orange, yellow and green light decreased in the order given. Activity was greater in the dark than in the light or in light of any one colour. The amount of oviposition was directly proportional to the amount of feeding. In experiments on control, adhesive preparations applied to the crowns of growing plants protected them from ovipositing females for a few days, after which the tips of the vines touched the soil and the weevils were able to crawl up them and oviposit in the stems. The yield of tubers from treated plants was lower than that from controls, and considerable plant injury occurred when calcium arsenate, copper arsenate and lime, but not cryolite, were added to the adhesives.

Floyd and L. D. Newsom (pp. 40–45) describe laboratory experiments on the toxicity to *C. formicarius* of poison baits prepared from grated tubers of sweet potato, as such baits might be used against the weevils that emerge from infested tubers left in the field or old storage sites and are responsible for early infestation of the crop, and also against weevils left in the field at harvest time. Paris green proved the best of several poisons tested. At concentrations of 5 and 1 per cent., it gave complete or almost complete mortality in about 3 and 5 days when the weevils had no alternative food ; it was still effective, though the time required was longer, when fresh food was supplied. The addition of molasses rendered the bait less effective. Freshly prepared baits often became mouldy and unattractive, but this was prevented by the addition of 0·32 per cent. sodium benzoate, which did not reduce their effectiveness. The baits showed no loss of efficiency as they became dry in the course of 56 days' use.

L. O. Ellisor (pp. 17–23) gives the results of work on the bionomics and control of *Anticarsia gemmatalis*, on soy beans [*cf.* **25** 542 ; **27** 371 ; **28** 481]. In studies over a period of four years, localised infestations of second-generation larvae, which are the first to become injurious, appeared between 1st and 15th August. The third generation, which appears about the middle of September, is the most damaging, and larvae present after October and November are rarely of great importance. In Louisiana, soy beans are the preferred food-plant until late in the season, when lucerne, the foliage of which is more tender at that time, is preferred. Cowpeas and ground-nuts [*Arachis hypogaea*] are defoliated when the available foliage of soy bean and lucerne is reduced by heavy infestations, and velvet beans [*Stizolobium*] may also be attacked. Other food-plants include sword beans [*Canavalia ensiformis*], *Robinia pseud-acacia* and *Sesbania macrocarpa*. No stages were observed on lucerne in southern Louisiana after heavy frosts had begun, and it is therefore concluded that cold is the limiting factor preventing the species from overwintering in the State. Observations in 1937 on April and June sowings of three varieties of soy bean that were upright, spreading and intermediate in habit, indicated that early plantings of the upright variety are likely to escape injury where there is an abundant supply of the more favourable spreading varieties, which provide cover for the adults during the day and have more tender foliage to attract oviposition, but that the June sowing is very susceptible to attack, since its foliage is still tender when the larvae appear in numbers. Plants that escape early injury are unlikely to be defoliated later in the season, since the larvae are then reduced by natural enemies.

Insect predators include wasps, the Pentatomids, *Podisus maculiventris*, Say, *Proxys punctulatus*, P. de B., and *Stiretrus anchorago*, F., the Carabid, *Calosoma sayi*, Dej., and Asilids, ants and Coccinellids. The percentage of the eggs parasitised by *Trichogramma minutum*, Ril., may rise to almost 100 by the end of the season. Other parasites, which are rarely of importance, include *Winthemia rufopicta*, Big., *Sarcophaga rapax*, Wlk., *Pimpla* (*Ephialtes*) *aequalis*, Prov., and *Ophion bilineatus*, Say. The fungus, *Spicaria prasina*, which infests the larvae, does not as a rule become effective until the prolonged cool, damp weather of late September or early October, but is capable of complete control. Only soy beans grown for seed are likely to require insecticide treatment, since those grown for forage or soil improvement can be harvested or ploughed under before serious damage occurs. In tests of insecticides, organic compounds did not control the larvae, but some inorganic compounds were toxic and did not injure the foliage. Good control was obtained in field trials in three seasons from Alorco cryolite [*cf.* **28** 482], used at the rate of 6–8 lb. per acre undiluted, or 10–14 lb. when diluted with an equal amount of a carrier such as talc. In extensive laboratory and limited field tests, basic copper arsenate compared favourably with cryolite in toxicity and dusting qualities, and did not injure the foliage.

C. E. Smith and R. W. Brubaker (pp. 23–31) give an account of investigations in 1936–39 to discover a substitute for arsenical insecticides against cabbage caterpillars of several species. Three dusts containing fixed nicotine were of little or no value. The yield of marketable cabbages following applications of a dust of derris and talc with a rotenone content of 1 per cent. was greater than that following applications of a similar dust with a rotenone content of only 0·5 per cent. or of undiluted calcium arsenate, but the protection afforded was not considered adequate. The results with various conditioning agents incorporated in the dusts of derris and talc were inconclusive.

A. L. Dugas and J. W. Ingram (pp. 32–34) give figures showing that infestation of sugar-cane by *Diatraea saccharalis*, F., was unusually low in 1940; the severity of the preceding winter had reduced the rate of survival of the hibernating larvae to only about 15 per cent. of the normal. They also (pp. 34–39) summarise the results of investigations in progress since 1937 on control by means of dusts of cryolite and other insecticides [**28** 254; **30** 413]. In large-scale field experiments in 1939, four applications of cryolite (5·91 lb. per acre at weekly intervals) reduced the number of larvae per acre in May and June and the percentage of joints bored at harvest to 73 and 17·7 as compared with 992 and 37·6 in an untreated area, and gave a net profit of over $11 per acre from increased yield of sucrose. Three applications gave smaller reductions and no net profit. Large and small-scale experiments in 1939 and 1940 appeared to indicate that dusting against the second-generation larvae is of doubtful value. In a discussion of present costs, it is suggested that the use of cryolite might be restricted to stubble cane in areas in which infestation is usually average or severe, since this might give a high degree of control over the whole plantation. It might also be of value in seed-plots and for valuable seedling canes; it caused no appreciable scorching in experiments.

Eddy (pp. 39–40) quotes a report by J. K. Primm describing work in 1939–40 on the control of the red spider [*Tetranychus*] on strawberry by means of Loro (a preparation containing aliphatic thiocyanates [*cf.* **28** 615]) used as a dip. Spraying with this material, even at high pressure, was ineffective owing to inadequate coverage of the lower surface of the leaves. In Louisiana, the spread of infestation is due almost entirely to the use of infested stock, and it is therefore necessary to destroy all stages on these plants before setting them out. Dips containing wettable sulphur or rotenone gave a high mortality of the mites but not of the eggs; nicotine sulphate (1 oz. per U.S. gal.) did not give complete mortality of the active stages. All stages were destroyed by a dip containing 1 U.S. pint Loro in 20 U.S. gals. water with the addition of 2 fl. oz. Grasselli Spreader-Sticker diluted in a little water, and no further treatment was required during the seasou. This quantity is sufficient to treat 12,000–15,000 plants. The mites breed on various weeds during the winter, and these should be destroyed in the immediate vicinity of fields in which dipped strawberry plants are set. In clean-cultivated fields, the spread of infestation from row to row was slow and appeared to be unimportant, at least until after the crop was harvested.

Eddy (pp. 45–47) gives brief notes on insect pests of peach. Observations indicate that cultural conditions promoting vigorous growth largely prevent serious attack by the shot-hole borer [*Scolytus rugulosus*, Ratz.], and the lesser peach-tree borer [*Aegeria pictipes*, G. & R.] and to a less degree by the peach-tree borer [*A. exitiosa*, Say] and Coccids. *A. exitiosa* can be safely and satisfactorily controlled by paradichlorbenzene on trees of or over four years of age, and by properly prepared ethylene dichloride emulsion on trees of all ages. Effective control of the San José scale [*Quadraspidiotus perniciosus*, Comst.] has been given by commercial or tank-mixed oil emulsions. The oriental fruit moth [*Cydia molesta*, Busck] causes important losses each year in the north-east of Louisiana and about every three years in the north-west and centre [*cf.* **29** 602] Parasites were introduced against it in 1940 and 1941.

The results of preliminary studies on the sand wireworm [*Horistonotus uhleri*, Horn] over a period of two years are discussed by Eddy (p. 51). Damage by the larvae was found to cease in the third week of June and seeds can therefore be safely sown at that time [*cf.* **29** 602]. Rotations that involve the planting of crops in July are unsuitable for use in the sandy districts in Louisiana, where reliance must be placed on the use of resistant crops, of which oats, vetch, crimson clover [*Trifolium incarnatum*], *Lespedeza*, groundnut and sweet potato are recommended. Lightly infested soil should be left fallow or planted with resistant crops for one year before cotton or maize are grown on it, but where infestation is moderate or heavy, an interval of at least two years must elapse. In experiments on control, beta-naphthol, paradichlorbenzene, and bran baits containing Paris green, calcium arsenate or sodium fluoride, all damaged the plants, but emulsified dichlorethyl ether in water controlled the wireworms without injuring either cotton or maize.

In a note on insect injury to potato tubers, Eddy (p. 52) states that the type known as heeled-hole injury that has appeared in Louisiana and other southern States seems to be due to larvae of *Diabrotica*, since the larvae were found in the tunnels, this type of injury increased when adults of *Diabrotica* were confined in cages over potato plants in two seasons, and the yield of tubers was greatly reduced when adults were caged over the plants in the early stages of growth. Other types of injury to tubers comprise surface erosions due to such insects as white grubs and mole-crickets, and tunnels below the skin of the tuber caused by the potato tuber moth [*Gnorimoschema operculella*, Zell.].

McConnell (H. S.). **The Pistol Casebearer in Maryland.**—*Bull. Maryland agric. Exp. Sta.* no. A7 pp. 173–187, 7 figs., 4 refs. College Park, Md., 1942. [Recd. 1944.]

An account is given of the bionomics and control of *Coleophora malivorella*, Ril., in Maryland, where it was first observed as a pest of apple in the autumn of 1938 and has since spread very slowly, and all stages of this Tineid are described. Both its life-history and the injury it causes are similar to those recorded in Pennsylvania [*R.A.E.*, A **30** 287]. About 90 per cent. of the eggs are laid on the upper surface of the leaves, most of them in the upper third of the trees. The newly hatched larvae mine in the leaves for 1–3 days, during which period they begin to make their cases, and then feed by perforating the leaves from the lower surface until early autumn, when they attach their cases to various parts of the tree, usually a twig or fruit spur. In spring they move to the leaf and fruit buds as soon as these begin to unfold and feed on them from about the end of March until the end of May. They then attach their cases to twigs and pupate in them. The adults readily fly for short distances when disturbed.

It has hitherto not been necessary to apply special control measures in Maryland, but serious infestations have developed in some orchards in spite of the normal applications of arsenicals against other apple pests. In experiments in 1939 on the control of the eggs and young larvae, summer-oil emulsion (0·83 per cent. oil) applied alone or with nicotine sulphate (1 : 800) or with fixed nicotine (4 lb. Black Leaf 155 per 100 U.S. gals.) on 5th and 16th July, and the last two sprays applied on 16th July only, reduced the average numbers of live larvae per 100 leaves when all had hatched to 5·9, 1·7, 3·1, 2·1 and 38, respectively, at the tops of the trees, as compared with 618 on unsprayed trees [*cf. loc. cit.*]. Sprays of summer oil at the same concentration with 4 lb. derris powder (4 per cent. rotenone) per 100 U.S. gals. applied on 16th July or 1st August reduced them to 1·1 and 3·1, but caused serious injury to the fruit and some damage to the leaves ; sprays of 4 lb. derris powder per 100 U.S. gals. water, applied on the same dates, reduced them to 9·6 and 7·8. These results were confirmed by further tests made in the following summer. In experiments in

the spring of 1940, a spray of 4 lb. derris powder and 8 lb. wettable sulphur per 100 U.S. gals. water, applied during the pink stage, killed approximately 80 per cent. of the overwintered larvae, but caused some difficulty with excessive foaming [*cf. loc. cit.*].

SCHELL (S. C.). **The Biology of *Hadronotus ajax* Girault (Hymenoptera-Scelionidae), a Parasite in the Eggs of Squash-bug (*Anasa tristis* DeGeer).**—*Ann. ent. Soc. Amer.* **36** no. 4 pp. 625–635, 16 figs., 12 refs. Columbus, Ohio, 1944.

An account is given of observations in 1940–41 on the life-history of *Hadronotus ajax*, Gir., carried out in the laboratory at Raleigh, North Carolina, where this Scelionid is one of the more important parasites of the eggs of *Anasa tristis*, Deg., on squash. It has no other known host. Adults were obtained from parasitised eggs collected in the field, the females were allowed to oviposit in vials, in eggs deposited in the laboratory, and the host eggs were subsequently dissected at intervals. The egg, larval and pupal stages, the morphology and growth of which are described, lasted 18–20 hours and 5–6 and 9–10 days, respectively. The adults pair soon after emergence from the host eggs and oviposition begins about two days later. Females produced an average of 16 eggs and usually laid only one in each host under normal conditions. Up to five were found in individual eggs when the parasites were numerous in the vials, but only one larva developed beyond the first instar. When kept at 75–85°F. in the laboratory and fed daily on diluted honey, the adults lived for up to 12 days ; those kept in tightly stoppered vials at 45°F., lived for 5–6 weeks without food or water.

In the district of Raleigh, the parasite probably produces at least four complete generations a year. In 1941, the first adults emerged on 24th July from parasitised eggs collected in the field and the last ones on 19th September. The percentages of eggs parasitised in August were 23 in 1940 and 42 in 1941. The ratio of males to females, based on collections of parasitised eggs, was 1 : 5. Parthenogenetic reproduction gave rise to males, but is probably uncommon under natural conditions, since only four of the numerous parasitised egg clusters collected in the field yielded males only.

In addition to *H. ajax*, the eggs of *A. tristis* were parasitised by *Ooencyrtus anasae*, Ashm., and *Anastatus* sp., and the adults by *Trichopoda pennipes*, F.

SIMMONS (P.). **Preventing Insect Damage in home-dried Fruits.**—*Leafl. U.S. Dep. Agric.* no. 235, 4 pp. Washington, D.C., 1943.

Fruits that are dried at home in the United States should be protected from attack by insects both while drying and before and during storage. The Indian meal moth [*Plodia interpunctella*, Hb.] and, in California and Arizona, the raisin moth [*Ephestia figulilella*, Gregson] oviposit on drying fruits in the evening ; the dried-fruit beetle [*Carpophilus hemipterus*, L.], which is active only during the day, is attracted especially to fruits that are moist or fermenting, and the saw-toothed grain beetle [*Oryzaephilus surinamensis*, L.] infests dried fruit that has been in storage for some time ; pomace flies [*Drosophila* spp.], the house-fly [*Musca domestica*, L.] and similar species feed on the juices of drying cut fruits ; and the dried-fruit mite [*Carpoglyphus passularum*, Hering] occasionally becomes established on stored dried fruit and imparts a disagreeable odour to it when present in large numbers.

Drying fruit should be screened, particularly late in the day when the moths are active, and the dried fruit should be stored in tight containers or at 50°F.

or less, which prevents the breeding of the pests. Infested fruit remaining from previous crops and other infested materials, such as grain and nuts, should be removed from the storage space, which should be thoroughly cleaned, and containers that have been used before should be immersed for a few seconds in boiling water. Fruit that becomes infested can be treated by heat or fumigation. Prunes and unsulphured raisins may be put in a muslin bag and dipped in boiling water for six seconds, after which they should be dried thoroughly, and figs and sulphured fruits should be exposed to dry heat ; exposure to about 150°F. for 1–1½ hours was effective for dates. Small quantities of fruit may be fumigated in a tightly closed container with a commercial mixture of ethylene dichloride and carbon tetrachloride. This should be poured into a shallow pan placed above the fruit, at the rate of about two teaspoonfuls per cubic foot of space, and the container should be kept closed for at least 12 hours.

Behre (C. E.) & Reineke (L. H.). **The Opportunity for Silvicultural Control of Gypsy Moth in southwestern Maine.**—*J. For.* **41** no. 11 pp. 811–815, 1 fig., 2 refs. Washington, D.C., 1943.

The authors point out that the increased demand for timber for fuel in the New England States provides an opportunity for rendering forests in that area more resistant to the gipsy moth [*Lymantria dispar*, L.] by reducing the proportion of preferred food-plants present and so restoring the original forest types. It is considered that serious damage is unlikely to occur, even in areas where infestation has been severe for twenty or more years, if preferred food-plants, such as grey birch [*Betula populifolia*], poplars, basswood [*Tilia*] or oak, comprise less than half the total foliage volume. Surveys were carried out in 1936–38 of the distribution of forest types in an area of 1,255,000 acres of forest in south-western Maine, parts of which have suffered severe defoliation in recent years. The 15,691 plots examined were assigned to five resistance-classes according to forest type, and an analysis of the data for places representing maximum, minimum and average infestation by classifying the susceptibility of each plot according to its specific composition indicated that the use of the five classes is justified. The percentages of preferred species in the classes are less than 10, in which no treatment is required ; 10–40, in which severe outbreaks are unlikely and a single silvicultural treatment should give a satisfactory composition ; 40–60, which can be modified by one treatment to prevent serious damage, but in which two are generally necessary to give a fully satisfactory composition ; 60–90, in which two or more treatments over a period of ten years are necessary, possibly with the addition of planting where advantage cannot be taken of an understory ; and 90–100, in which the encouragement of an understory of less favoured species or the planting of suitable trees are necessary. Of the forests in south-western Maine, 25 per cent. need no protective treatment, 55 per cent. can be made resistant by a single treatment, and the problem is acute in only about 12 per cent.

The development of more resistant stands is facilitated by the active reproduction of white pine [*Pinus strobus*] which takes place on the light soil characteristic of most of the infested area ; cultural measures favouring the increase and improvement of pine, together with attention to the prevention of fires, as a result of which the proportion of oak is increased, and the avoidance of clear cutting, which is followed by invasion by grey birch, are likely to be encouraged owing to their assistance in providing protection from *L. dispar*. In planning large-scale silvicultural control, priority should be given to those forest types in which the excess of potential loss over cost of treatment is greatest, The five susceptibility classes and four silvicultural priority classes for 33 forest types and the bases for determining priority are shown in tables.

Stone jr. (E. L.) & Schwardt (H. H.). **White Grub Injury to young Plantations in New York.**—*J. For.* **41** no. 11 pp. 842–844, 5 refs. Washington, D.C., 1943.

White grubs [chiefly species of *Lachnosterna*] are not only pests of some importance in forest nurseries in New York State [*R.A.E.*, A **29** 421] but also injurious in newly-established plantations. In the summer of 1941, seedlings of red pine [*Pinus resinosa*] planted that spring over ten acres were almost all destroyed by them and mortality among Japanese larch [*Larix kaempferi*] over one acre was at least 80 per cent. ; self-sown seedlings of small hardwoods in old fields and planted oak seedlings were also killed. E. W. Littlefield reports in correspondence that losses occurred at several points in northern New York State between 1926 and 1940, and A. H. MacAndrews, who reports serious damage to pine planted in old fields, considers that injury due to these larvae may often be attributed to other causes. The coincidence of high larval populations and new plantations has hitherto probably been too infrequent to result in any but local losses.

Of the 30–35 species present in the State, most require three years to complete their development ; food-preferences of the larvae are not known, but feeding on the roots of tree seedlings is thought to be incidental. The only brood of importance is Brood C, adults of which were more numerous and widely distributed in 1940 than in 1937 and are expected to show a still further increase in 1943. Injury by the larvae continues or increases until their numbers are reduced by natural control factors, and as a large flight occurs only once in three years and most of the parasites have a one-year life-cycle, the latter do not quickly increase to effective numbers. Droughts during the hatching and pupation periods also reduce the numbers of a brood, but conditions are rarely sufficiently severe in New York State to cause any large-scale reduction. Chemical control [*cf.* **31** 7] is not practicable in large plantations and attention must therefore be turned to preventive measures. In the year after a major flight year, when damage is likely to be most severe, planting should be avoided in grassland and should be restricted to less susceptible cover types, especially where damage has occurred in the vicinity. Fields in which weeds are abundant are relatively safe, and areas under shrubs or small trees are least subject to injury, although heavy oviposition usually occurs in openings near aspen [*Populus tremuloides*], which is a preferred food-plant of the adults. Fields that have been heavily damaged are often fairly free from infestation by larvae of the next generation, probably because the sod was still too open for oviposition at the time of emergence of the large population of adults. A further precaution is to estimate the number of small larvae present in the August of a major flight year from the examination of four square-yard quadrates per acre ; where 40 or more are present per square yard, young trees planted in the following year are likely to be destroyed, and smaller numbers of larvae can probably cause severe injury. Established seedlings are better able to withstand attack, although they may be heavily damaged.

Fulton (B. B.). **The Cabbage Maggot in North Carolina.**—*Bull. N.C. agric. Exp. Sta.* no. 335, 24 pp., 6 figs., 6 refs. Raleigh, N.C., 1942. [Recd. 1944.]

Hylemyia brassicae, Bch., is absent over the greater part of North Carolina, but is an important pest of cabbages, turnips and other crucifers in the mountain area in the western part of the State, usually at altitudes of 3,000 ft. or more. Observations on its seasonal history in 1937–39 indicated that it probably produces three overlapping generations a year, but serious damage is caused only by the first. Adults from overwintered pupae occur from early April to July, but are numerous only about the middle or end of May. Most of the eggs are laid round the stems of the plants just below the surface of the soil, and hatch in

3–8 days. The larvae feed for a month or more, many pupating in July, and the pupal period normally lasts about a fortnight.

Experiments on control with solutions of mercuric chloride (corrosive sublimate) at various concentrations, and mercurous chloride (calomel) as a suspension in water (1 oz. to 10 U.S. gals.) or a dust in talc (1 : 20 by weight) were carried out in 1937–39 to ascertain their effectiveness in the region concerned, where showers are frequent. The results, which are given in detail in tables, showed that all were effective, though three weekly applications were usually required, and conditions may have been rather favourable, as no application was followed by rain in less than six hours. Some alternative insecticides were also tested in 1939, but those that did not contain mercury were ineffective, as were also 5 per cent. dusts of mercuric sulphide or yellow mercuric oxide. A suspension of 1 oz. yellow mercuric oxide in 10 U.S. gals. water was about as effective as a solution of mercuric chloride at the same concentration. Suspensions of the oxide or of mercurous chloride gave fair control without injury to cabbage seedlings when used in a single application at the rate of 4 oz. to 10 U.S. gals., but were not more effective than they were in two applications at the usual rate of 1 oz.

Details are given of the methods of preparing the effective insecticides for application. The suspensions have the disadvantage of requiring almost constant agitation, and the dust is more difficult to apply. The standard concentration for the solution of mercuric chloride is 1 oz. to 10 U.S. gals., but 1 oz. to 12–15 U.S. gals. is advised if the ground is very dry, the soil sandy or some of the plants still germinating. The first treatment should be made within a week after the plants in the seed-beds come up.

The need for treatment with insecticides can, however, be largely avoided by delayed planting. The safe date varies with the season, and suggestions are made for ascertaining it from the dates of flowering of local plants. New seed-beds should be as far as possible from the old ones or fields in which crucifers were grown during the previous autumn. The roots of the seedlings should be examined before planting out, and, if more than 8–10 per cent. are infested, they should be washed and then dipped in a solution of mercuric chloride (1 oz. to 10–15 U.S. gals. water), and the plants set before the solution dries on the roots. Other cultural methods are the removal of cabbage stumps from the fields in the autumn, the elimination of wild crucifers, and the fertilisation of seed-beds to raise the resistance of the plants to the effects of infestation. Radishes are more severely infested than cabbages, but did not protect the latter when grown with them as a trap crop.

In North Carolina, *H. brassicae* is frequently confused with *H. antiqua*, Mg., which is confined to onions, and *H. cilicrura*, Rond., which infests a large number of plants, including cabbage. *H. cilicrura* is widely distributed in the State, but is destructive much earlier in the spring than *H. brassicae*. Flea-beetles are sometimes injurious in cabbage seed-beds but not on the field crops ; the adults attack the seedlings in the cotyledon stage and the larvae subsequently feed on the roots. In the course of the experiments on *Hylemyia*, however, the beetles were effectively controlled, and subsequent damage by the larvae prevented by two applications of a dust containing 1 per cent. rotenone.

Miller (E. M.) & (D. B.). **A preliminary Study on the Distribution and Habits of South Florida Termites.**—*Proc. Fla Acad. Sci.* **6** no. 3–4 pp. 101–107. Gainesville, Fla., 1944.

Emerson (A. E.) & Miller (E. M.). **A Key to the Termites of Florida.**—*T.c.* pp. 108–109.

The first paper contains notes on the bionomics and ecology of the 13 species of termites known from Florida, and the second consists of keys to the imagines and soldiers. In the southern part of the State, where all the species are

represented, the major damage to buildings is due to *Reticulitermes hageni*, Banks, and *R. virginicus*, Banks. *Prorhinotermes simplex*, Hagen, attacks structures with a high moisture content, *Kalotermes snyderi*, Light, damages telephone poles, and *K.* (*Cryptotermes*) *brevis*, Wlk., attacks furniture, door-frames, etc.

SNYDER (T. E.) & ZETEK (J.). **Effectiveness of Wood Preservatives in preventing Attack by Termites.**—*Circ. U.S. Dep. Agric.* no. 683, 24 pp., 6 figs., 13 refs. Washington, D.C., 1943.

The authors discuss the preservation of wood, and particularly its protection from attack by termites; describe methods of treating it by pressure and non-pressure processes and of testing the efficiency of different treatments, usually by burying treated stakes of pine sapwood to half their length in infested soil in the Panama Canal Zone [*cf. R.A.E.*, A **27** 180; **32** 61, etc.]; and give an account of the properties, uses and relative effectiveness of oils that make the wood unsuitable for painting, water-soluble preservatives that are recommended for the treatment of wood that will not be in contact with the ground or water or that must be painted, and toxic chemicals, dissolved in some colourless and usually volatile solvent other than water, which do not swell the wood and leave it odourless and paintable and which are therefore suitable for treating finished articles such as doors, window frames and furniture.

Coal-tar creosote is the most effective preservative known; coal-tar distillates of higher specific gravity and boiling point (anthracene oils) are similar in efficiency, but wood creosotes, pine tar, pine-oil derivatives and creosotes from water-gas tar are less effective. Stakes with an average absorption of 14·5 lb. per cu. ft. of a mixture of equal quantities of coal-tar creosote and petroleum oil were all in good condition after exposure for about ten years. Arsenic in various forms has given satisfactory results for a number of years; stakes impregnated with approximately 15–25 lb. per cu. ft. of fuel oil containing 1 per cent. methyl arsenious oxide or 0·67 per cent. methyl arsenious sulphide were protected for about ten years. Petroleum oil alone and with 5 per cent. dinitronaphthalene protected 62·5 and 75 per cent., respectively, of stakes containing about 14·5 lb. per cu. ft. for ten years.

A minimum retention of 1 lb. per cu. ft. is recommended for zinc chloride, applied in a 2–5 per cent. aqueous solution; half this quantity protected wood that was insulated from the ground for 14 years, but 1·52 lb. preserved buried stakes for only about 38 months. Zinc meta-arsenite protected insulated wood for ten years at 0·27 lb. per cu. ft., and buried stakes for 73 months at 0·77–1·17 lb. Celcure, a proprietary mixture of copper sulphate, potassium bichromate and acetic acid, protected 75–87·5 per cent. of stakes containing very high impregnations for about ten years; the absorption specified for insulated timber is 0·5 lb. per cu. ft. Although this preparation is sold for application by brush, spray or dipping, as well as by pressure, the former treatments give very shallow penetration and are not recommended. Tanalith U, which is said to consist of sodium fluoride, sodium chromate, anhydrous disodium arsenate and dinitrophenol ($25 : 37\frac{1}{2} : 25 : 12\frac{1}{2}$) protected 75 per cent. of the stakes impregnated with an average of 1·45 lb. per cu. ft. (practically five times the quantity recommended by the manufacturers) for about ten years; the absorption specified for insulated timber is 0·35 lb.

In tests of 5 per cent. solutions of tetrachlorphenol in light petroleum oils, 75 per cent. of pine stakes impregnated with 13·8 lb. solution per cu. ft. were in good condition after ten years; comparable results after five years were obtained in similar tests in the United States with absorptions of 0·5 lb. pentachlorphenol. Other recently developed preservatives include beta-naphthol and alpha-nitronaphthalene, which are ordinarily used as 5 per cent. solutions in volatile solvents or in petroleum oils of the fuel-oil grade, but there are not enough service records of them to warrant conclusions as to their effectiveness.

Superficial treatments, such as brushing or brief soaking, do not give effective permanent protection, but creosotes, anthracene oils, coal tar and copper or copper-bronze paints preserved timbers in contact with the ground for an average of 5–6 years when brushed on, and have also protected painted wood used above ground from attack by dry-wood termites. Another method of protection consists in injecting aqueous solutions of metallic salts into standing or freshly felled trees [*cf.* **28** 336] ; the preservative is well distributed through the tree in about ten days, but the heaviest absorptions are in the lower parts of it.

Large-scale tests of wood-pulp products or fibreboards of various types into which poisons had been incorporated during the course of manufacture are briefly described. White arsenic (arsenious acid), zinc meta-arsenite and certain proprietary arsenicals have protected fibreboards for 5-8 years when used at the rate of 0·2 per cent. of the dry weight of the board in the United States and at 0·6 per cent. in the Canal Zone. In the same localities, pentachlorphenol at 0·75–1 per cent. has protected fibreboards for five years.

Howe (R. W.) & Oxley (T. A.). **The Use of Carbon Dioxide Production as a Measure of Infestation of Grain by Insects.**—*Bull. ent. Res.* **35** pt. 1 pp. 11–22, 2 graphs, 7 refs. London, 1944.

Since the insects and mites that infest stored wheat have a metabolic rate enormously greater than that of the grain in which they live, it was considered that the rate of production of carbon dioxide in infested grain might give a satisfactory measure of the infestation. A method is described by which an air-tight container was filled with the grain to be tested and kept at 25°C. [77°F.] for 24 hours, after which the percentage of carbon dioxide in the interstitial air was measured. This percentage, which is termed the carbon dioxide figure, is directly proportional to the rate of production of carbon dioxide, as the proportion of air in all varieties of wheat is nearly constant (about 38·5–39·5 per cent.).

Theoretical sources of variation in the results and the practical utility of the method are discussed. It proved useful in population studies in the laboratory when certain precautions were taken, but its chief application probably lies in routine observation of grain in storage. The carbon dioxide concentrations resulting from grain considered suitable for prolonged storage, storage for a few months or storage under close observation and from grain that is unfit for storage are given. Uninfested grain that is damp or mouldy also produces a high concentration of carbon dioxide, but such grain is also unfit for storage.

The estimation of the population of certain insects and mites in the grain from the concentration of carbon dioxide is described. The precision of the estimate depends on the information available, which is usually limited to an indication of the species present, obtained by sieving, and the water content of the grain. The numbers of individuals of certain species per lb. grain that produce 1 per cent. carbon dioxide in 24 hours at 25°C., which incidentally indicate their relative importance in causing heating in grain, are shown in a table.

Variations in intergranular air spaces are negligible in all varieties of wheat, peas, haricot beans, polished rice and similar small, huskless, hard grains, and correction factors are given to enable the method to be applied to commodities having intergranular spaces considerably different from those of wheat.

Kevan (D. K. McE.). **The Bionomics of the Neotropical Cornstalk Borer, *Diatraea lineolata*, Wlk. (Lep., Pyral.) in Trinidad, B.W.I.**—*Bull. ent. Res.* **35** pt. 1 pp. 23–30, 20 refs. London, 1944.

The life-histories of *Diatraea lineolata*, Wlk., and *D. saccharalis*, F., in maize in Trinidad are similar [*cf. R.A.E.*, A **32** 37], and the two species are therefore

dealt with together in this account of laboratory and field observations. The lives of the adults are short, averaging approximately 2·75 days for the males and 4 for the females. In the laboratory the total number of eggs deposited per female and the number per cluster averaged 377·5 and 8·96 for *D. lineolata* and 333·3 and 10·1 for *D. saccharalis*; only 62·3 per cent. of the eggs of *D. lineolata* hatched. The egg, larval and pupal stages of *D. lineolata* lasted 5, 22–48 and 6–13 days and those of *D. saccharalis* 5, 21–50 and 6–10 days.

If the maize is young and the tassels have not appeared, the newly hatched larvae skeletonise small patches of leaf for a day or two and then burrow into the terminal bud. On older maize, they feed on the cob sheaths and then burrow into them. Some of the larvae complete their development in the cobs, but most of them, like those in the buds, emerge when they have reached the third instar, migrate on the stem to the shelter of a leaf-sheath, and then bore into the stem and tunnel upwards to the ears or, more usually, downwards. Some larvae leave the stems and enter them again elsewhere. Pupation occurs in a chamber at the end of the tunnel.

A detailed account is given of the diapause undergone by *D. lineolata* in dry maize stalks throughout the dry season [*cf.* **31** 259; **32** 37]. It was found that the condition of the maize stalks themselves determined whether the larvae would enter the resting stage or not, rainfall and relative humidity having no direct bearing on its initiation. The resting stage occurred only in the case of larvae more than half grown, and very seldom in any less than three-quarters grown. The results of two small-scale experiments indicated that contact moisture is the most important factor in the breaking of dormancy; high relative humidity does not appear to be necessary, and high humidity alone is probably not sufficient [*cf.* **31** 259].

ANDREWARTHA (H. G.). **Air Temperature Records as a Guide to the Date of Hatching of the Nymphs of *Austroicetes cruciata*, Sauss. (Orthoptera).**—*Bull. ent. Res.* **35** pt. 1 pp. 31–41, 4 figs., 7 refs. London, 1944.

In South Australia, *Austroicetes cruciata*, Sauss., has only one generation a year, and the eggs hatch after a prolonged diapause [*R.A.E.*, A **30** 510, 511; **31** 349]. The date of hatching depends on the rate of development of post-diapause eggs, which is influenced by soil temperatures. By working with thermograph records of soil temperatures and dividing the day into twelve two-hour periods, a satisfactory estimate for the rate of development was obtained. When these data were combined to give the mean daily rate of development for monthly periods, it was found that the mean maximum temperature was a more reliable guide to the mean daily rate of development than was the mean daily temperature for the month. A curve was constructed relating the mean daily rate of development to the monthly mean maximum temperature. This curve was used to estimate the date of hatching of *A. cruciata* in South Australia for each of 51 years (1892–1942); the mean monthly maximum air temperatures were estimated for June, July, August, September and October of each year, corrections were introduced to allow for the fact that the eggs occur about an inch below the surface of the soil, and the mean daily rate of development was then read directly from the curve. This method does not give a precise estimate of the rate of development in the field, but it does provide a useful comparison between one year and another with reference to the general earliness or lateness of hatching in the spring. Early hatching is one factor favourable for the multiplication of grasshoppers, and a comparison of a curve of grasshopper incidence with that of date of hatching during 1892–1942, showed that outbreaks of *A. cruciata* tended to occur in, or to follow, years in which the eggs hatched early.

MARSHALL (Sir G. A. K.). **New injurious Curculionidae from Africa (Col.).**—*Bull. ent. Res.* **35** pt. 1 pp. 43–48, 3 figs. London, 1944.

The new species are described from adults of both sexes, and were found feeding in the adult stage on the plants on which they are recorded. They comprise *Protostrophus hirtiventris* on ground-nuts (*Arachis hypogaea*), young maize and granadilla [*Passiflora*], and *P. dimorphus* on young tobacco plants, both in South Africa, and *Scolochirus* (gen. n.) *armipes*, and *Chelyophyes* (gen. n.) *hemisphaericus*, both on leaves of cacao in the Ivory Coast. Adults of *Cosmogaster lateralis*, Gylh., which has not previously been reported to be harmful, are recorded as biting off young cotton plants at soil level in the Ivory Coast.

MOUTIA (L. A.). **The Sugar-cane Scale, *Aulacaspis tegalensis*, Zehnt.**—*Bull. ent. Res.* **35** pt. 1 pp. 69–77, 1 pl., 2 figs., 10 refs. London, 1944.

Chionaspis (*Aulacaspis*) *tegalensis*, Zhnt., which was first recorded in Mauritius in 1899, has spread over most of the western coastal belt of the island since 1937 [*cf. R.A.E.*, A **28** 244] and now occurs in patches over about 4,500 acres of sugar-cane. As its continued spread might result in losses to the sugar industry of the whole island, investigations were made in 1941–42 on its life-history and control. The adult female and various immature stages are described by R. Mamet, who states that the figure of the adult female of *C. tegalensis* from Formosa given by Ferris in a paper already noticed [**10** 41] does not agree with the form that occurs in Mauritius, and that the differences are sufficient to separate the two forms into specific aggregates. Comparison with type material is required to determine which represents the true *C. tegalensis*, which was originally described from sugar-cane in Java.

A list is given of the varieties of sugar-cane that are reported to be infested in Mauritius, of which those with persistent and adherent leaf-sheaths, and particularly P.O.J. 2878, are the most severely damaged [*cf.* **26** 501]. Injury results in a reduction in yield of cane and in the sucrose content of the juice, amounting to 5–15 tons per acre and about 35 per cent., respectively. Laboratory and field observations showed that the females deposit 150–250 eggs, which hatch in about 6–7 days in summer and 10–12 days in winter. The crawlers wander on the food-plant for 24–48 hours before settling. The period required for development from egg to adult averaged 24 days for males and 28 for females at temperatures of 24–27°C. [75·2–80·6°F.] and a mean relative humidity of 74 per cent. The mortality of the eggs was 2 per cent. in summer and 17 per cent. in winter and that of the crawlers was 40 per cent. The scale generally occurs on the cane stems, but leaf blades and leaf sheaths are also attacked in severe infestations. Damage is generally observed from February to August, when the canes are reaped, and at least six generations occur during this period. In ratoon fields, infestation may start as early as December on cane stalks left with a view to inducing rapid growth of young shoots. Cane fields adjoining infested ones are generally attacked by scales that are carried by wind, but infestation is not very severe during the first year of attack.

The natural enemies of this Coccid in Mauritius are *Chilocorus politus*, Muls., and *C. nigritus*, F., introduced in 1937 and 1939 for the control of *Aspidiotus destructor*, Sign., on coconut [*cf.* **26** 204; **29** 610; **31** 161], *Lindorus lophanthae*, Blaisd. [*cf.* **28** 244], *Cybocephalus* sp. and two Chalcidoid parasites, *Tetrastichus* sp. and *Homalotylus* sp. The three Coccinellids were rare in infested fields in January and most abundant in July, when the scale was prevalent. The lengths of their egg, larval and pupal stages and complete life-cycles in summer and winter are shown in a table. The parasites were abundant in infested cane fields during May and June.

It was found that the Coccid bred freely on cane cuttings that were left in the field and exposed to the sun for 30 days, but could not survive for more than 10–12 days on cuttings buried in the soil. When infested cuttings were planted, the new shoots showed no sign of attack, and it is considered unlikely that new fields will be infested by plant material from infested ones provided that there is no delay in planting. The practice of keeping extra stalks in the field after the crop season should be discontinued as they are main sources of infestation and reinfestation. The removal of trash from heavily infested fields resulted in an increase of about 26 per cent. in the sugar content of the juice, an increase in parasitism from 2·6 to 90 per cent., and a greater abundance of Coccinellids [*cf.* **31** 217], and this treatment is recommended for places where irrigation is available. The development of varieties of sugar-cane with loose leaf-sheaths and desirable commercial qualities is suggested.

Laing (F.). **A new injurious Mealy-bug from the Gold Coast.**—*Bull. ent. Res.* **35** pt. 1 pp. 91–93, 1 fig. London, 1944.

The author describes the female of *Pseudococcus exitiabilis*, sp. n., which was found on cacao (*Theobroma cacao*) at Tafo, Gold Coast, and discusses its affinities. This mealybug and another, *Ferrisia virgata*, Ckll., are reported by H. E. Box to be vectors of the swollen-shoot virus disease of cacao [*cf. R.A.E.*, A **32** 26].

In a supplementary note, the author reviews the fixations of types for the genera *Pseudococcus*, Westw., and *Lecanium*, Burm., and points out that his use of the former name in its commonly accepted sense for a genus of mealybugs is incorrect. *Lecanium* is a synonym of *Coccus*, L., as the type of both is *hesperidum*, L. A later fixation of *persicae*, F., as the type of *Lecanium* is invalid, but the name *Eulecanium*, Ckll., is available for the genus to which *persicae* belongs.

Pemberton (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass. 1942–43* pp. 14–18. Honolulu, 1943.

Insect pests of sugar-cane were again unimportant in Hawaii in the year ending 30th September 1943. Injury by *Rhabdoscelus* (*Rhabdocnemis*) *obscurus*, Boisd., continued to be light [*cf. R.A.E.*, A **31** 524], and *Anomala orientalis*, Waterh., had caused no measurable damage to sugar-cane for six years. There was no evidence of the establishment of the parasites and predators of *Anomala* introduced from Guatemala [*cf.* **24** 379.; **31** 524, etc.], but *Campsomeris marginella modesta*, F. Sm., and *Tiphia segregata*, Crwf., continued to be abundant in infested areas. *Oxya chinensis*, Thnb., *Aphis sacchari*, Zhnt., *Perkinsiella saccharicida*, Kirk., *Nacoleia* (*Omiodes*) *accepta*, Btlr., *Trionymus sacchari*, Ckll., *Pseudococcus boninsis*, Kuw., and *P. brevipes*, Ckll., caused practically imperceptible damage.

No outbreaks of *Laphygma exempta*, Wlk., have occurred in Hawaii since the discovery of the parasite, *Blondelia* (*Eucelatoria*) *armigera*, Coq. [*cf.* **31** 474], but it is not known what part the Tachinid plays in armyworm control. *Apanteles marginiventris*, Cress., introduced from Texas for the control of *Laphygma*, has become established on Oahu and Kauai, in spite of the great scarcity of the host. Carpenter bees [*Xylocopa varipuncta*, Patton], the extensive borings of which seriously weaken and disfigure soft timber, especially redwood [*Sequoia*], used for posts and in buildings, were quickly eliminated by blowing cryolite dust into the tunnels; treated timbers have remained free of infestation for many months. The most destructive insect intercepted in aircraft during the year was *Prodenia litura*, F., which is very injurious to vegetable and other crops in many parts of the world, though it is not known to attack sugar-cane; it is likely to be introduced as it occurs on some of the islands near Hawaii, including Canton, Midway and Fiji. The moths were found on three occasions, being alive on two of them, and apparently the usual spray treatment given in all aircraft does not always kill them.

MARRIOTT (S.). **Breeding Jassid-resistant Cotton Varieties.**—*Qd agric. J.* **57** pt. 4 pp. 204–206. Brisbane, 1943.

An account is given of experiments made in Queensland in an attempt to obtain a variety of cotton that possesses desirable commercial qualities and is resistant to attack by Jassids [*Empoasca*], the symptoms of which are described [*cf. R.A.E.*, A **27** 281]. The experiments were made with the Miller 41 variety, which is extensively grown in Queensland, produces good quality lint, and is adapted to a wide range of conditions; in addition, individual plants that are resistant to Jassids occasionally appear, and initial tests showed this character sometimes to be inheritable. As, however, a seed-plot of the most resistant strain raised from individual plants was destroyed by the spur-throated locust [*Austracris guttulosa*, Wlk.] and only a small residue of seed was left, the more rapid but less efficient method of mass-selection was adopted to make seed more quickly available for commercial planting. Seed was collected in a heavily-infested field of Miller 41 from all the plants that appeared to be resistant except those with important undesirable characters, and gave rise in the following season (1941–42) to plants that were uniformly hairy and showed less leaf-curl than the nearest plants of Miller cotton on similar soil. It has been shown that resistant plants are generally hairy, though all hairy plants are not resistant [*cf.* **29** 517], but under certain conditions of soil and soil-moisture, both hairy and smooth plants may appear resistant, and their susceptibility can only be determined by raising their progeny under conditions of heavy infestation. In 1941–42, Jassid attack was light and re-selection impracticable; all the seed was accordingly sown, and produced good yields of cotton of satisfactory quality in 1942–43. This strain (41J) is distinguished from the parent by its increased hairiness, but owing to its heterogeneous nature, the increase in resistance to Jassids is estimated to be only 20 per cent. A further mass-selection was made, but in order to prevent severe losses most of the seed produced in 1942–43 was to be released for immediate use. Another strain raised in 1938–39 from seed from a single plant exhibited marked resistance and uniformity in plant and lint characters and produced a good yield of cotton; disadvantages of this strain are that the boll is only medium in size and the plant rather leafy in habit.

Another series of experiments were carried out in an attempt to raise satisfactory resistant varieties by hybridising Miller cotton with imported resistant strains, all of which have found to be commercially undesirable, and making repeated back-crosses of the resistant hybrids with the Australian parent. Plants of the first back-cross generation resembled the Miller variety in producing large bolls and cotton of coarse fibre, and selected plants exhibited a high degree of resistance. Further experiments are being made with three strains.

SMITH (J. H.). **Insect Pests of Cabbages and Cauliflowers.**—*Qd agric. J.* **57** pt. 4 pp. 217–225, 7 figs. Brisbane, 1943.

Notes are given on the bionomics and control of the insects that attack cabbage and cauliflower in Queensland, with a key to them based on the appearance of the injurious stage and the character of the damage caused. They comprise cutworms, the centre grub [*Hellula undalis*, F.], the cabbage moth [*Plutella maculipennis*, Curt.], the cluster caterpillar [*Crocidolomia binotalis*, Zell.], the corn ear worm [*Heliothis armigera*, Hb.], the cabbage Aphid [*Brevicoryne brassicae*, L.], the green peach Aphid [*Myzus persicae*, Sulz.], thrips, and the cabbage white butterfly [*Pieris rapae*, L.], which has only recently been recorded in Queensland, and has not as yet appeared in the main vegetable-growing areas.

Basu (A. C.). **Effect of different Foods on the larval and post-larval Development of the Moth *Prodenia litura* Fb. (Lepidoptera, Noctuidae).**—*J. Bombay nat. Hist. Soc.* **44** no. 2 pp. 275–288, 2 graphs, 11 refs. Bombay, 1943.

An account is given of laboratory experiments carried out in Calcutta to find additional food-plants of *Prodenia litura*, F., and to determine the effect of variations in food on development. Lists of food-plants are given from the literature, with an additional 20 plants on which the larvae developed in these experiments, and the effect of green fruits of banana and papaya and leaves of cabbage, cauliflower, cotton, lettuce, mulberry and palam [spinach] on the size of the larva, pupa and adult and on the length of the larval and pupal stages, when the insects were reared at approximately 19–22°C. [66·2–71·6°F.] and at 30°C. [86°F.], are shown in tables and discussed in detail. Cauliflower, mulberry, lettuce and palam resulted in short larval and pupal periods and large insects, cotton leaves caused long developmental periods and small insects, and banana, cabbage and papaya were intermediate in effect. All three stages were larger and development took longer at the lower temperatures than at the higher one.

Hem Singh Pruthi & Mohan Singh. **Stored Grain Pests and their Control.**—*Misc. Bull. Coun. agric. Res. India* no. 57 (2nd revd. edn.), 41 pp., 12 pls. (3 col.), 22 figs., 4 pp. refs. Delhi, 1943.

In this revision of a bulletin on the insects attacking stored grain in India [*cf. R.A.E.*, A **9** 78], the authors give brief accounts of the appearance and bionomics of the chief pests of cereals and the Bruchids that infest pulses and describe preventive and remedial measures for their control. The latter include the use of various fumigants, inert and poisonous dusts, repellents, superheating, refrigeration and trapping. Methods of storage, above and below ground, used in various parts of the country are described in considerable detail, and the natural resistance of different grains to insect attack is briefly discussed.

Rodrigo (E.). **Administration Report of the Acting Director of Agriculture (Ceylon) for 1942.**—16 pp. Colombo, 1943.

Brief sections of this report (pp. D4–D5) deal with work on insect pests and plant diseases in Ceylon in 1942. In tests of hydrocyanic acid gas for fumigating infested grain, 4 oz. sodium cyanide per 100 cu. ft. space with an exposure period of 24 hours was necessary to destroy all stages of *Calandra* [*oryzae*, L.], and this treatment reduced the viability of the grain. Complete mortality of all stages of *Bruchus* sp. in pulses and of *Sitotroga* [*cerealella*, Ol.] was given in six hours by a dosage of 1 oz. sodium cyanide and the viability of the grain was not affected. Sulphur dioxide proved an unsatisfactory fumigant as it tainted the grain and impaired its germination. Paradichlorobenzene acted so slowly that it would be suitable for use only on small quantities of seed for planting; the minimum effective dosage was 5 oz. per 100 cu. ft. with an exposure period of 96 hours. Grain was freed from insect infestation without loss of viability by exposing it in $\frac{1}{4}$-inch layers to 140°F. for 30 minutes or 150°F. for 20 minutes. Storing loose, well-dried grain in bulk under a 1-inch layer of fine, dry sand was successful in arresting and preventing insect infestation.

In continued studies on value of liberating *Trichospilus pupivora*, Ferrière, against *Nephantis serinopa*, Meyr., on coconut in eastern Ceylon [*cf. R.A.E.*, A **29** 620, 621, etc.], the parasite was found to be seriously reduced in numbers during the dry season, even in places where it was well-established, and although large releases were made during the dry season, no appreciable effect on the host was observed until the onset of the wet season. Continuous liberations throughout at least two wet seasons and the intervening dry one appear to be necessary in

order to obtain complete control. Damage to fruit by moths of the genus *Othreis* was reduced from 50 to 2 per cent. by using smudge fires in the orchards for 2–3 hours in the late evening and early night during the harvesting period. Trap jars baited with sweetened fruit extract were of value only until the fruit in the orchards began to mature, when they should be removed.

Aqueous sprays containing extracts of *Emilia sonchifolia* and preparations from the kernels of the fruit of *Thevetia neriifolia* showed no insecticidal action, though concentrations of the latter, which were tested against Aphids, were twice those reported to be effective in India [*cf.* **30** 303]. Extracts from pyrethrum grown in Ceylon were fairly toxic to Aphids when tested as aqueous sprays in kerosene emulsion.

Investigations on a virus disease of tomatos that causes leaf-curl and stunted growth showed that it is transmitted by grafting and by Aleurodids, but not by inoculation of sap.

GADD (C. H.). **Report of the Mycologist for 1942.**—*Bull. Tea Res. Inst. Ceylon* no. 24 pp. 22–31. Talawakelle [1943].

The view that phloem necrosis of tea in Ceylon is caused by a virus was confirmed in 1942 by its successful transmission by grafting. The Coccid, *Saissetia coffeae*, Wlk., is considered to be the most likely insect vector [*cf. R.A.E.*, A **29** 175 ; **30** 319], as it is prevalent in the badly affected areas and has, like the disease, a localised distribution and limited powers of dispersal, but attempts to transmit the virus by transferring scales from diseased shoots to healthy cuttings have not yet been successful. In the laboratory, an average of 40–45 eggs were deposited and hatched beneath the parent scale, the nymphs emerging over a period of a fortnight or more. They moulted three times, the instars lasting 20–41, 12–41 and 18–51 days. Oviposition began 19–59 days after the final moult and the offspring emerged 15–22 days later. First-instar nymphs usually attacked the ends of the shoots, and the older ones the bases of the shoots and the undersides of older leaves. About a quarter of the nymphs did not move after the initial period of activity, but some of the remainder moved as many as eight times. These movements occurred in each instar and in some cases continued until immediately before egg-laying. Both adults and nymphs fed on the phloem, and this fact and the repeated movements of the insect are of significance with regard to its possible importance as a vector of the virus.

GADD (C. H.). **Report of the Entomologist for 1942.**—*Bull. Tea Res. Inst. Ceylon* no. 24 pp. 32–36. Talawakelle [1943].

Cockchafer larvae are known to destroy the roots of tea in Ceylon, but ringing of the plants had not been attributed to them. In 1942, however, some were found near tea cuttings that had bark removed from the stems, and twelve rooted cuttings were therefore caged with single larvae from September until November, when eight of them showed this type of injury, varying in degree from slight damage to complete girdling. Control plants were uninjured. Somewhat similar injury was observed on tea seedlings, young gum trees [*Eucalyptus*] and well grown *Hibiscus* cuttings. Much of the information given on the shot-hole borer of tea [*Xyleborus fornicatus fornicatior*, Egg.] has already been noticed [*cf. R.A.E.*, A **31** 296 ; **32** 28]. Its galleries weaken the stems, and manuring is believed to accelerate their healing [*cf.* **15** 210]. Preliminary examination of the numbers of broken branches after every plucking, during the second year after pruning, in each plot of a manuring experiment, however, gave no indication that they were less numerous in manured than in unmanured plots.

Nettle grubs [Limacodids] were reported from only eight estates in 1942 [*cf.* **31** 159]. Weekly inspections of tea bushes from 31st March showed that *Natada nararia*, Moore, was the most abundant species. *Natada* larvae were most numerous in the middle of April. Adults and newly deposited eggs were observed on 12th May, and newly hatched larvae on 17th May. Larval populations of this generation were much lower, but reached a peak on 16th June. No larvae were observed from 28th July until 11th August, when newly hatched larvae of the next generation were found. The larval populations of this generation and the last were progressively smaller and reached peaks on 1st September and 17th November, respectively. The life-cycle appeared to last about three months and there was no overlapping of generations. A wilt disease and Braconid parasites [*cf.* **29** 174], which do not control the larvae until they are half-grown, have been considered to be the most important natural enemies of Limacodids, but field observations indicated that Eulophids of the tribe Euplectrini cause considerable mortality among young larvae before much damage has been done. All the commoner species of nettle grubs are readily attacked by adults and nymphs of *Cantheconidea robusta*, Dist. Observations on 20 nymphs and 20 adults fed in captivity showed that one individual consumed 28 *Natada* larvae during the nymphal period and 101 during six weeks of adult life. Adults lived for 51 days and then died from lack of food. Oviposition began 9–17 days after the last moult. The eggs were laid on the tea leaves in masses of up to 137 ; the greatest number of egg masses laid by one female was 16 and the greatest number of eggs 929. The nymphs do not feed for four days after hatching ; they are gregarious, but the adults are solitary.

Living branches of *Gliricidia* were attacked by *Xyleborus semigranosus*, Bldf., in one district ; as the galleries are mainly confined to the pith, infestation is unlikely to be noticed until the tree is lopped. A consignment of plywood from Japan for tea chests was infested with *Lyctus brunneus*, Steph., and one of local manufacture with *Heterobostrychus aequalis*, Waterh. As both species attack only wood containing starch, the use of starch-free timber is suggested.

Franklin (H. J.) & others. **The Cranberry Station, East Wareham, Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* no. 398 (Rep. 1942) pp. 26–29. Amherst, Mass., 1943.

In 1942, infestation of cranberry by *Tlascala finitella*, Wlk., was again serious in the same area in Massachusetts as in 1941 [*cf. R.A.E.*, A **31** 428]. Moths that emerged very late in May were caged with cranberry branches on 30th May, and on 13th June, small larvae were found to have done considerable feeding, indicating that the incubation period is about ten days. *Tortrix* (*Cacoecia*) *parallela*, Rob., was more abundant than for many years, and a severe outbreak occurred over about nine acres early in June ; most of the larvae matured by 8th July, but some remained until after 16th July, when the moths had begun to fly. Dusting with 30 lb. cryolite per acre on 25th June gave satisfactory control. The Ichneumonid, *Itoplectis conquisitor*, Say, and the Tachinid, *Nemorilla floralis*, Fall., were the most important parasites of this Tortricid, but four other Ichneumonids and three Chalcidoids were also reared from it. A list is given of 16 weeds in and near the infested bog on which the larvae were observed to feed. Young nymphs of *Clastoptera* [*saint-cyri*, Prov.] were found as early as 2nd June, but flooding the bog for 24 hours as soon as an occasional flower had opened controlled a heavy infestation without affecting the plants or crop. The application of a solution of sodium cyanide (7 oz. per 100 U.S. gals. water) at the rate of 1 U.S. gal. per sq. ft. late in April and very early in May controlled *Amphicoma* [*vulpina*, Hentz] and did not reduce the crop, injuring the plants on only a few small areas. Larvae of *Cirphis* (*Leucania*) [*unipuncta*, Haw.] were abundant in bogs that had been flooded from mid-May to mid-July for

the control of this Glaphyrid. Treatment with sodium-cyanide solution was also effective against *Anomala lucicola*, F. (formerly reported as *A. errans*, F. [*cf.* **25** 715 ; **26** 645 ; **30** 459]), which was injurious in a bog not previously known to be infested. Populations of *Mineola* [*vaccinii*, Ril.], the black-headed fireworm [*Rhopobota naevana*, Hb.], *Anthonomus* [*musculus*, Say] and the cranberry tipworm [*Dasyneura vaccinii*, Smith] were normal, *Xylena* [*nupera*, Lint.] was again very prevalent, *Peronea* [*minuta*, Rob.] and the cranberry girdler, *Crambus* [*hortuellus*, Hb.] were more injurious than usual and the blossom worm, *Epiglaea* [*apiata*, Grote] was scarce.

Cranberry plants are very intolerant of sulphur, but tolerant of kerosene and copper. Cryolite, applied at the rate of four tons per acre on 20th June 1941, had caused severe injury by July 1942. Dusting plants approaching full bloom with 4 lb. mercurous chloride (calomel) in 96 lb. talc per acre on 1st July 1941 did not affect the yield, but delayed ripening so much that the berries did not develop a good colour. They were picked towards the end of September, when chemical and spectroscopic examination showed no sign of mercury. The plants were less green than untreated ones in the autumn of the same year, and bore only about one-third as much fruit in 1942, though they then appeared normal.

Alexander (C. P.) & others. **Department of Entomology.**—*Bull. Mass. agric. Exp. Sta.* no. 398 (Rep. 1942) pp. 34–40. Amherst, Mass., 1943.

A heavy infestation of the European red mite [*Paratetranychus pilosus*, C. & F.] developed in commercial apple orchards in practically all parts of Massachusetts in 1942, causing much bronzing of the leaves even on relatively resistant varieties ; foliage injury was observed by mid-June and the attack reached its peak in most places by late July or early August. A dust containing 1·7 per cent. of a dicyclohexylamine salt of dinitro-o-cyclohexylphenol and a spray containing 20 oz. per 100 U.S. gals., with a spreading and wetting agent, gave uniformly good control of the mites when applied during the growing season, and caused no tree injury if used carefully under suitable conditions. In experiments, sprays containing 12, 16 and 24 oz. per 100 U.S. gals. gave good control on two varieties of apple ; slight marginal scorching occurred in a few cases, but could not be definitely attributed to the treatment and was of no commercial significance. Neither the spray nor the dust injured several types of ornamental trees and shrubs, but sumac [*Rhus*], raspberry and grape-vines showed some injury. A commercial product containing approximately 20 per cent. dinitro-o-cyclohexylphenol, applied at concentrations of 12 and 24 oz. per 100 U.S. gals. water on 23rd July, gave good control with no serious injury to foliage, though slight marginal scorching occurred on some tender leaves.

To test its effectiveness against the overwintering larvae of the codling moth [*Cydia pomonella*, L.], a solution of pyrethrum in kerosene was applied early in April, when the trees were still dormant, to the rough bark of the trunk and to the base of the larger branches of apple trees, which received no other sprays against this insect. More than four times as many fallen and picked apples from untreated trees as from treated ones showed damage by the larvae, and the solution caused no injury to the bark and did not retard seasonal development. It apparently had no permanent repellent action on the larvae, as approximately the same numbers were collected in chemically treated bands on sprayed and unsprayed trees at the end of the growing season. This treatment eliminates the necessity for most of the scraping of loose bark from the trees and should also be very effective against larvae hibernating in piles of prop poles. Substituting a fixed nicotine (14 per cent. nicotine) for lead arsenate in the fourth cover spray of the standard schedule reduced the percentage of apples damaged by *C. pomonella* from 4 to 1·5 ; apples from untreated trees showed 19·4 per cent. injury. Where fixed nicotine was also applied in the middle of August,

damage at harvest was less than 0·6 per cent. A modified schedule in which the quantity of lead arsenate in the second, third, fourth and mid-August sprays was reduced and a commercial preparation of pyrethrum and rotenone was added to them practically eliminated codling moth damage. An application of fixed nicotine between the second and third cover sprays, to give protection between 12th June and 9th July, increased the degree of control. All these materials were found to be compatible with the wettable sulphur used as a fungicide.

Oviposition by the overwintered generation of the apple leaf-curling midge [*Dasyneura mali*, Kieff.] was negligible ; adults emerged again during 20th–25th July and 8th–15th August, and oviposition was heaviest during 18th–27th August. Large numbers of larvae were collected in bands on 28th July and 10th September, and on each occasion rainfall exceeded 1 inch. Of the larvae collected in June, July and August 1941, 0, 0 and 67 per cent. gave rise to adults in 1942 [*cf. R.A.E.*, A **31** 430]. Practically no adults emerged from soil beneath lightly infested trees when flake naphthalene was applied at the rate of 2 lb. per 100 sq. ft., and spraying with rotenone or a dinitro compound when oviposition was at a maximum appreciably reduced the number of infested tips, though a pyrethrum spray was ineffective. In studies on the effect of different amounts of spray applied to apple trees against the plum curculio [*Conotrachelus nenuphar*, Hbst.], a rate of 1 U.S. gal. per 100 sq. ft. was significantly more effective than one of $\frac{3}{4}$ U.S. gals., but not consistently less effective than one of $1\frac{1}{4}$ U.S. gals. At a concentration of 4 lb. per 100 U.S. gals. water, cryolite was less effective than lead arsenate and caused severe russetting. Trials with sprays containing 2, 3 and 4 lb. lead arsenate per 100 U.S. gals. indicate that the highest concentration is necessary for satisfactory control where *C. nenuphar* is abundant.

Pruning destroyed 72 per cent. of the eggs of the grape plume moth [*Oxyptilus periscelidactylus*, Fitch] when it removed 79 per cent. of the nodes and canes of the grape-vines, as compared with 55 per cent. when it removed 50 per cent.

In experiments against the squash vine borer [*Melittia satyriniformis*, Hb.], a spray containing 1 per cent. Volck oil and 0·2 per cent. nicotine sulphate again gave the best control [*cf. loc. cit.*]. A dust containing copper oxychloride-sulphate and 0·75 per cent. rotenone was also effective and of considerably more value than one of yellow cuprous oxide containing 3 per cent. of a solution of pyrethrins in oil. A mixture of 20 per cent. dinitro-o-cyclohexylphenol and 80 per cent. gypsum reduced infestation by nearly 66 per cent., but the crop from plants treated with it was only slightly greater than that from the controls. Squash plants dusted with a mixture of calcium arsenate and copper oxychloride (5·25 per cent. tricalcium arsenate) were more heavily infested than untreated plants, but produced the largest crop obtained during the experiments, and it is concluded that a light infestation, especially when it occurs after the secondary roots have developed, does not seriously reduce the yield. This dust gave 90 per cent. mortality of the striped cucumber beetle [*Diabrotica melanocephala*, F.] on cucumber and 100 per cent. on melon ; infestation was light, however. The dust of rotenone and copper oxychloride-sulphate was as effective against *Diabrotica* when the rotenone content was only 0·5 per cent. as when it was 0·75, the latter being of slightly greater value on cucumber and the former on melon. The dust of pyrethrum and yellow cuprous oxide was generally satisfactory, though less effective than the rotenone dusts ; when the cuprous oxide was omitted, control was reduced to about 50 per cent., but, apparently owing to the partial control of Aphids and other vectors of mosaic disease, the yield of melons following this treatment was the greatest obtained during the experiments.

Infestation by the cabbage maggot [*Hylemyia brassicae*, Bch.] was severe, and 88–90 per cent. commercial injury occurred among untreated plants of susceptible varieties. Two applications of a solution of 1 oz. mercuric chloride

(corrosive sublimate) in 15 U.S. gals. water gave control equal or superior to that given by the same number of applications of the solution at the usual concentration (1 oz. in 10 U.S. gals.). A dust containing 2 per cent. mercurous chloride (calomel) in talc was almost as effective as one containing 4 per cent. when applied by the mound method, but significantly inferior when two applications were made by means of hand-dusting equipment. In field trials of insecticides against the onion thrips [*Thrips tabaci*, Lind.], the standard spray of nicotine sulphate and soap was the most effective, and gave 87 per cent. control, but a commercial rotenone solution was almost as satisfactory and gave greater residual protection. A spray containing extractives from the seeds of castor [*Ricinus communis*] was ineffective, largely owing to its oily nature and poor wetting properties, but one of a pine oil derivative in a penetrating soap and another of nicotine tannate both gave 74 per cent. control; the value of the former was not increased by the addition of derris. A pyrethrum dust (Pyrocide) gave 70 per cent. control. Sprays applied in the form of a solid cone were more satisfactory and penetrated better than the usual hollow-cone types. Populations of the thrips increased rapidly in late July; the fungus disease that normally appears when the thrips are numerous [**22** 650] was not present.

Flea-beetles [*Epitrix cucumeris*, Harr.] were again the only injurious insects on potatoes during the year. Injury measured by the number of feeding punctures per sq. in. leaf surface, on plants sprayed eleven times between 5th June and 25th August with Bordeaux mixture of varying concentrations, varied inversely with the strength of the Bordeaux mixture, but was always reduced by the incorporation of calcium arsenate. This reduction was greatest (50 per cent.) on plots sprayed with Bordeaux mixture containing only half the normal quantities of copper sulphate and lime, and was only slight where the full-strength mixture (5 : 5 : 50) was used. The protection afforded by all concentrations tested and the yield from plants sprayed with them were satisfactory, but a plot treated with a proprietary neutral copper fungicide was badly infested by *E. cucumeris* and by August many plants in it were dead.

Baris scolopacea, Germ., which was first recorded in Massachusetts in 1941, was destructive to sea-kale beet (Swiss chard), which was rendered unmarketable by the egg cavities and feeding punctures in the stems. Preliminary trials indicated that rotenone dusts are effective against this weevil. During the late summer and autumn of 1942, celery at several places was severely damaged or destroyed by *Lygus campestris*, L., which punctured the heads and new stalks, thus providing a means of entry for a bacterial or fungous rot. A spray of derris with a wetting agent gave satisfactory control when application was begun while infestation was still light.

Adults of the European corn borer [*Pyrausta nubilalis*, Hb.] again emerged while the maize plants were too small to attract oviposition [*cf.* **31** 431], and as the overwintering populations were small, infestation was at first light, though it later increased and was more normal on maize ripening in late August and September. Sprays of nicotine bentonite and dusts of dual-fixed nicotine both gave good protection. The use of 3 instead of 2 lb. nicotine bentonite (14 per cent. nicotine) in 100 U.S. gals. spray resulted in considerably increased control, but no advantage was given by further increases in concentration. Many of the infested ears from the treated plots contained only small larvae, whereas those in infested ears from untreated plots were fully-grown, and the ears unmarketable.

Satisfactory control of the red spider mite [*Tetranychus*] on greenhouse plants was given by a mixture of monochlornaphthalene and flake naphthalene (3 : 1) vaporised at a rate of only $\frac{3}{4}$ oz. per 1,000 cu. ft. for an exposure period of three hours. At 60°F., there was no significant difference between the mortalities at relative humidities of 50, 60, 70 and 80 per cent. The development of this mite appeared to be retarded on carnation and rose plants in which the pH of the sap was high.

In work on the effect of solar heat on the development in elm logs of *Hylastes* (*Hylurgopinus*) *rufipes*, Eichh., and *Scolytus multistriatus*, Marsh., which was found at four additional places during the year, most of the upper half of uninfested newly-felled logs placed in early spring in such a position that the sunlight fell on them all day remained uninfested by Scolytids throughout the season. The logs did not exceed 4 ft. 4 ins. in diameter and the bark was less than $2\frac{1}{4}$ ins. thick. The mortality of beetles in similar logs that were infested before being placed in the sun varied inversely with the thickness of the bark.

In tests of materials that might be incorporated in sprays or dusts to repel honey-bees, creosote was found to be the most effective repellent, but it was injurious to apple foliage. Ant poisons containing thallium sulphate or arsenicals were both found to be toxic to honey-bees, but the action of the latter is more rapid and they are therefore less likely to be carried back to the hive. Experiments indicated that bees are unlikely to be poisoned by ant baits in salve boxes or other containers.

RIEDL (W. A.). **Dusting for Potato Psyllid Control.**—*Bull. Wyo. agric. Exp. Sta.* no. 260, 20 pp., 5 figs. Laramie, Wyo., 1943.

Investigations on the control of *Paratrioza cockerelli*, Šulc, on potato in Wyoming [*cf. R.A.E.*, A **30** 400] were continued in 1941 and 1942. In 1941, the treatments and rates per acre per application were 2 U.S. gals. lime-sulphur or 1 U.S. gal. lime-sulphur and 4 lb. wettable sulphur in 80 U.S. gals. water, and 30 lb. of dusting sulphur (98 or 93 per cent. 325 mesh), tribasic copper sulphate or a mixture of sulphur and red copper oxide (94 : 6). They were applied on 21st July and 12th and 27th August. The two dusting sulphurs contained an inert conditioning agent to prevent lumping, and the dusts were applied from a machine equipped with a hood to confine them round the plants. Counts made at weekly intervals during the growing season showed that all the treatments reduced the populations of adults, eggs and nymphs. Sulphur dust, with or without red copper oxide, gave as good control as the sprays or better ; tribasic copper sulphate was least effective. All treatments except tribasic copper sulphate gave significant or nearly significant increases in yield ; these were greatest for the two dusting sulphurs and progressively less for the spray of wettable sulphur and lime-sulphur, sulphur dust with red copper oxide and the lime-sulphur spray. On both yield and population figures the coarser dusting sulphur was slightly superior to the finer one.

The treatments and rates per acre in 1932 were : 2 U.S. gals. lime-sulphur in 80 U.S. gals. water ; 37 lb. conditioned dusting sulphur (98 per cent. 325 mesh) ; 30 lb. conditioned dusting sulphurs (microfine and 93 per cent. 325 mesh); 20 lb. unconditioned dusting sulphur (93 per cent. 325 mesh) ; 27 and 28 lb., respectively, of mixtures of sulphur with calcium arsenate and cryolite (2 : 1) ; and 37 lb. of a mixture of sulphur and basic copper sulphate (9 : 1). They were applied on 9th and 30th July and 12th and 25th August, and the numbers of adults on treated and untreated plants were compared weekly from 21st July to 9th September. The average reductions in their numbers were 59–76 per cent. for the dusts and 48 per cent. for the spray ; the unconditioned dusting sulphur gave the best control, but is difficult to handle. All the treatments gave significant increases in yield, with no significant difference between them except that the yield for the sulphur dust containing copper sulphate was higher than that for the unconditioned dusting sulphur alone. Fungous disease was not a factor, but it is possible that the copper had a stimulating effect on the plants. The microfine sulphur gave good yields of potatoes of a high quality, but is expensive and should be tested further to determine whether lower rates of application will afford satisfactory control. The effectiveness of the mixtures containing calcium arsenate and cryolite against leaf-chewing insects could not be determined as these were not numerous. In a subsidiary test, the same dusting sulphur

applied at the rates of 20 and 30 lb. per acre on the same dates gave slightly higher yields at the higher rate, but the differences were not significant. The comparative costs of spraying and dusting are discussed, and it is concluded that dusting is cheaper, quicker and easier, and results in less damage to the plants and the fields. General recommendations for dusting are appended.

DUDLEY jr. (J. E.) & BRONSON (T. E.). **The Pea Aphid on Peas and Methods for its Control.**—*Fmrs' Bull. U.S. Dep. Agric.* no. 1945, 14 pp., 8 figs. Washington, D.C., 1943.

Much of the information in this paper on the biology of *Macrosiphum onobrychis*, Boy. (*pisi*, Kalt.) and methods for its control on peas in the United States is based on investigations by the Bureau of Entomology in co-operation with the Wisconsin Agricultural Experiment Station. It occurs on peas in all parts of the country and is one of the most serious pests of this crop. It also attacks lucerne, which ranks next to peas as a favoured food-plant, clovers [*Trifolium*] and sweet clovers [*Melilotus*], which are seldom damaged to any extent, and vetches, of which it is sometimes a pest [*cf. R.A.E.*, A **31** 108]. The viviparous females reproduce throughout the year on peas and other leguminous plants in the south; in the north, the Aphid overwinters in the egg stage on stems and fallen leaves of lucerne and some clovers, and breeds on the lucerne in spring, but migrates from it about the time that it begins to blossom. In a belt through the central part of the country, overwintering eggs may be laid or viviparous females may overwinter in a more or less inactive state, or both may occur together. Parthenogenetic reproduction continues from spring to autumn, and about 15 generations are produced in Wisconsin, where the males and oviparous females appear in October. Until recently it was thought that this Aphid could not migrate to any great distance, but accumulated evidence indicates that certain heavy infestations in Illinois and Wisconsin have been borne by southerly winds for 25–100 miles or more.

Natural enemies are numerous but do not normally effect control, which requires an insecticide able to destroy at least 90 per cent. of the Aphids at one application. Methods for determining the degree of infestation in a crop, the most effective times for treatment and the preparation of several efficient insecticides are discussed. Machinery used may damage a small proportion of plants but actual measurements show that damage caused by a truck with 6-in. treads, carrying a machine dusting a 24-ft. swath of peas, ranged from 1·8 to 3·6 per cent., in weight, of marketable pods during 1939–41. One of the most satisfactory treatments is the application of 35–40 lb. per acre of a dust containing derris or cubé with talc or pyrophyllite and having a minimum rotenone content of 0·5 per cent. Its efficiency is increased by the inclusion of oil or other conditioning agent [*cf.* **26** 740; **29** 353; **31** 166] or the addition of nicotine alkaloid or of a commercial organic thiocyanate mixture at the rate of 2 per cent. by weight [**31** 400, 491]. In preparing mixtures with nicotine, the cubé or derris should be mixed with sulphur before the nicotine is added so that sulphur constitutes about 10 per cent. of the finished dust. These dusts are best applied with a power duster having a 25-ft. apron enclosing a boom adjustable to the height of the plants. Sprays composed of ground derris or cubé with a suitable wetting agent [**25** 560, etc.] are effective if they have a rotenone content of about 0·015 per cent. and are applied at the rate of 125–200 U.S. gals. per acre, under a pressure of at least 300 lb.; the speed of the sprayer should not exceed 3–4 miles per hour. Nicotine vapour, obtained from a preparation containing 80 per cent. free nicotine used at the rate of 3 lb. per acre, is very effective, the concentrated preparation is injected into the exhaust pipe of a petrol engine running at high speed and is blown out through a boom under a gas-proof cloth, 100 ft. or more in length, which

is dragged over the field at a speed of 100 ft. per minute [*cf.* **26** 21, etc.]. A fairly effective control is given by a dust of nicotine sulphate, monohydrated copper sulphate and hydrated lime (10 : 10 : 80), applied under a light trailer at least 40 ft. long at a speed of 100 ft. per minute ; or by a spray of 1 U.S. gal. nicotine sulphate and 15 lb. soap in 500 U.S. gals. water, applied at the same rate and by the methods recommended for derris or cubé sprays.

Entomology and economic Zoology.—*53rd Rep. Arizona agric. Exp. Sta. 1941–42* pp. 50–52, 1 ref. Tucson, Ariz., 1943.

Myzocallis (*Monellia*) *costalis*, Fitch, was abundant on pecan trees in the Yuma district of Arizona in 1941 ; its numbers fluctuated throughout the summer, but reached a peak towards the end of August. Attempts to eradicate the sexual forms by dusting in October were unsuccessful, but a dust of 4 lb. nicotine sulphate and 4 lb. sodium carbonate in 100 lb. hydrated lime gave fairly satisfactory general control.

Several years' work has shown that cotton is the preferred food-plant of *Creontiades femoralis*, Van D. [*cf. R.A.E.*, A **27** 417], which leaves lucerne and other crops as soon as the cotton begins to flower in early summer. Its numbers then increase rapidly, and it causes serious injury during August and September.

Papers noticed by Title only.

Bedford (E. C. G.). **The Biology of the Citrus Thrips** [*Scirtothrips aurantii*, Faure, in the Transvaal].—*Fmg in S. Afr.* 1943 repr. no. 39, 5 pp., 2 figs. Pretoria, 1943. [*Cf. R.A.E.*, A **32** 162.]

Mimeur (J. M.). **Plantes hôtes des Aphididae du Maroc (2e addition).**—*Bull. Soc. Sci. nat. Maroc* **22** pp. 139–140, 1 ref. Rabat, 1943. [*Cf. R.A.E.*, A **24** 392.]

Blanchard (E. E.). **Los Dípteros Muscoídeos del Museo de La Plata. Primera parte : Tachinidae** [including *Peleteria* (*Aphriosphyria*) *grioti*, sp. n. (1943) bred from *Cirphis unipuncta*, Haw., in Santa Fe (Argentina)].—*Rev. Mus. La Plata* (N.S.) **2** & **3** Zool. pp. 341–379 & 123–161, 29 figs. La Plata, 1941 & 1943. [Recd. 1944.]

Thompson (W. R.) Ed. **A Catalogue of the Parasites and Predators of Insect Pests. Section 1. Parasite Host Catalogue. Part 3. Parasites of the Hemiptera.** —$10\frac{3}{4} \times 8\frac{1}{4}$ ins., v + 149 pp. multigraph. Belleville, Ont., Imp. Parasite Serv., 1944. Price $ (Canad.) 2. (Also obtainable from Imp. agric. Bur., 2 Queen Anne's Gate Bldgs., London, price 10*s.*) [*Cf. R.A.E.*, A **32** 106.]

Bibliography on Insect Pest Resistance in Plants (with a Supplement on Resistance to Nematodes).—39 pp. Cambridge, Imp. Bur. Plant Breed. Genet., 1944. Price 1*s.* 6*d.*

Insects infesting Cacao Beans, including their Life History and Methods of Control. References covering the Period 1930–1938.—*Sci. Lib. bibliogr. Ser.* no. 494, 5 pp. multigraph. London, Science Museum, 1939. [Recd. 1944.]

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